CITY OF LODI

COUNCIL COMMUNICATION

AGENDA TITLE: Public Benefits Program Grant – United Congregational Church Demand-side Management Project ($75,769.75)

MEETING DATE: June 7, 2000

PREPARED BY: Electric Utility Director

RECOMMENDED ACTION: That the City Council approve a Public Benefits Program grant in the amount of $75,769.75 for a demand-side management project at United Congregational Church.

BACKGROUND INFORMATION: United Congregational Church (located on the corner of Hutchins Street and Tokay Street) has embarked upon a multi-faceted energy efficiency and equipment improvement project. Specifically, United Congregational Church will be installing and/or retrofitting the following items within their facility:

- removing a number of inefficient HVAC (heating & cooling) units on the classroom area of the church property, and installing new, highly efficient HVAC heat pump units;
- retrofitting all existing classroom, office space and sanctuary lighting with state-of-the-art fluorescent lighting and associated controls;
- installing a new, 15-ton energy efficient air cooled chiller (air conditioning system) for the sanctuary;
- replacing the existing boiler, with a new, highly efficient piece of equipment that will compliment the aforementioned 15-ton chiller;
- installing a new automated control logic system (often referred to as an energy management system), designed to allow church personnel the ability to remotely schedule (turn on/off) and operate the facilities HVAC system.

Attached for Council review is a copy of the comprehensive engineered energy analysis compiled by the City of Lodi Electric Utility and the city's energy services partner, Energy Masters International. The report, which has been presented to representatives of United Congregational Church, further outlines the energy efficiency and equipment improvement projects currently proposed, as well as other pertinent information regarding this effort.

The Public Benefits Program grant in the amount of $75,769.75 reflects a 25% energy efficiency incentive rebate for the total cost of the project to United Congregational Church. The 25% rebate is consistent with all other rebates offered to commercial and industrial electric utility customers throughout Lodi that participate in the City of Lodi Energy Services Partnership Program (which is an element of the City of Lodi Public Benefits Program).

FUNDING: 164605 – Public Benefits Program Fund (Category – Demand-side Management)

FUNDING APPROVAL: Vicky McAthie, Finance Director

Alan N. Vallow, Electric Utility Director

PREPARED BY: Rob Lechner, Manager of Customer Programs

ANV/RL/lst

C: City Attorney

APPROVED: H. Dixon Flynn - City Manager

701 SOUTH HUTCHINS

UNITED CONGREGATIONAL CHRISTIAN CHURCH

LODI, CA 95240 209 368-1955

May 16, 2000

Mr. Alan Vallow
Electric Utilities Director
1331 South Ham Lane
Lodi, California 95242

Dear Mr. Vallow:

We the members of the United Congregational Christian Church are excited about the opportunity to upgrade our beautiful facilities with enhancements to both our climate control and lighting systems. These improvements will allow us to worship in comfort, and to offer a pleasing environment for meetings, concerts, and weddings to our community at large.

We appreciate the monies made available through the Public Benefits Program to help defray incurred expenses, and respectfully request $75,770.00 from this fund.

We appreciate, as well, the tireless assistance of Rob Lechner and the representatives from Energy Masters, Inc. Their expertise and cooperative spirit helped make a seemingly daunting task manageable.

Very truly yours,

Rev. Dr. James R. "Bo" Crowe
Pastor

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SECTION ONE
EXECUTIVE SUMMARY

Energy Masters International is pleased to submit this final report outlining a Comprehensive Energy Management and Facilities Upgrade Plan for the United Congregational Christian Church (UCCC). In this document we describe what we can accomplish and present a detailed cost-to-savings ratio analysis. This report is the result of extensive on-site study and technical analyses, and is reflective of our desire to deliver the most cost effective, state-of-the-art and reliable energy and operational savings solutions possible.

With over twenty years in the energy efficiency services and performance contracting industry, Energy Masters possesses a long history of successful energy partnerships. Our vendor independent approach assures that the UCCC will receive the most objective and cost-effective program possible. We are a subsidiary of Northern States Power Company (NSP), an investor owned utility providing electricity and natural gas, with annual revenues in excess of $2.5 billion and assets exceeding $6.2 billion. This alliance, along with our vast experience in energy services and objective approach to energy retrofit practices, will provide the church with a package of services unsurpassed.

This CEA was conducted in the following seven steps:

1. An on-site visit to each building to conduct a detailed survey of the:
    - facility operating procedures and schedules;
    - construction details including type and condition of doors and windows;
    - heating, ventilating and air conditioning (HVAC) equipment to determine capacity, operation and condition, including operational measurements where pertinent and practical;
    - entire lighting system, space by space, recording type and condition of fixtures, operation and typical light levels;
    - all other specified energy consuming equipment or procedures; and
    - review of each building's architectural, mechanical and electrical drawings.

2. Building heating, cooling and ventilation requirements were calculated to verify whether the existing equipment is properly sized.

3. Analysis of one year of utility data to identify historical changes and to establish an energy baseline which will be used as the beginning reference point.

4. Identification, development and analysis of all potential energy saving improvements. These analyses were accomplished through hand calculated engineering procedures.

5. Determination of firm costs for the design, installation and project management of each energy saving measure.

6. Preparation and presentation of the detailed CEA report to the UCCC.

This comprehensive energy analysis includes the church sanctuary, administration, classrooms and multi-purpose rooms. Our project team of Steve Croockewit, Mitch Anderson, and Steve Brown (Air Systems) extends its thanks to Diane Nantt, Pastor Bo Crowe, Carol Williams, the board-of-directors and all of the buildings' staff members for their complete cooperation in producing this analysis.

The goals of the United Congregational Christian Church Facilities Upgrades and Energy Efficiency Program are simple, yet significant:

1. Provide the UCCC with a more productive and comfortable learning, worshiping, working and occupant environment.

2. Upgrade and/or replace old, inefficient and failed systems.

3. Increase the UCCC's profitability through additional revenue generation from community utilization.

4. Reduce the UCCC's energy, operating and maintenance costs.

5. Maintain or enhance safety and security levels.

Goal Achievement

The following measures represent an immediate and cost effective means by which to achieve the goals stated above:

Sanctuary

1. Install air conditioning for the sanctuary.

2. Retrofit the existing lighting system and install automated occupancy controls.

3. Install a new automated and programmable temperature control system.

4. Replace failed heating hot water supply piping.

Classrooms

1. Replace existing package HVAC units with High Efficiency Heat Pumps.

2. Retrofit the existing lighting system and install automated occupancy controls.

3. Install a new automated and programmable temperature control system.

4. Re-condition existing HVAC unit in Plymouth room; add heat strip and programmable thermostat.

5. Optional roof replacement.

Central Plant

1. Replace existing boiler with high efficiency boiler

2. Commission hydronic system and perform needed system maintenance, repairs and upgrades.

Facilities Maintenance and Monitoring Services

1. Provide 3 year preventive maintenance on all HVAC and Controls systems.

2. Provide 3 year facilities supervised monitoring services.

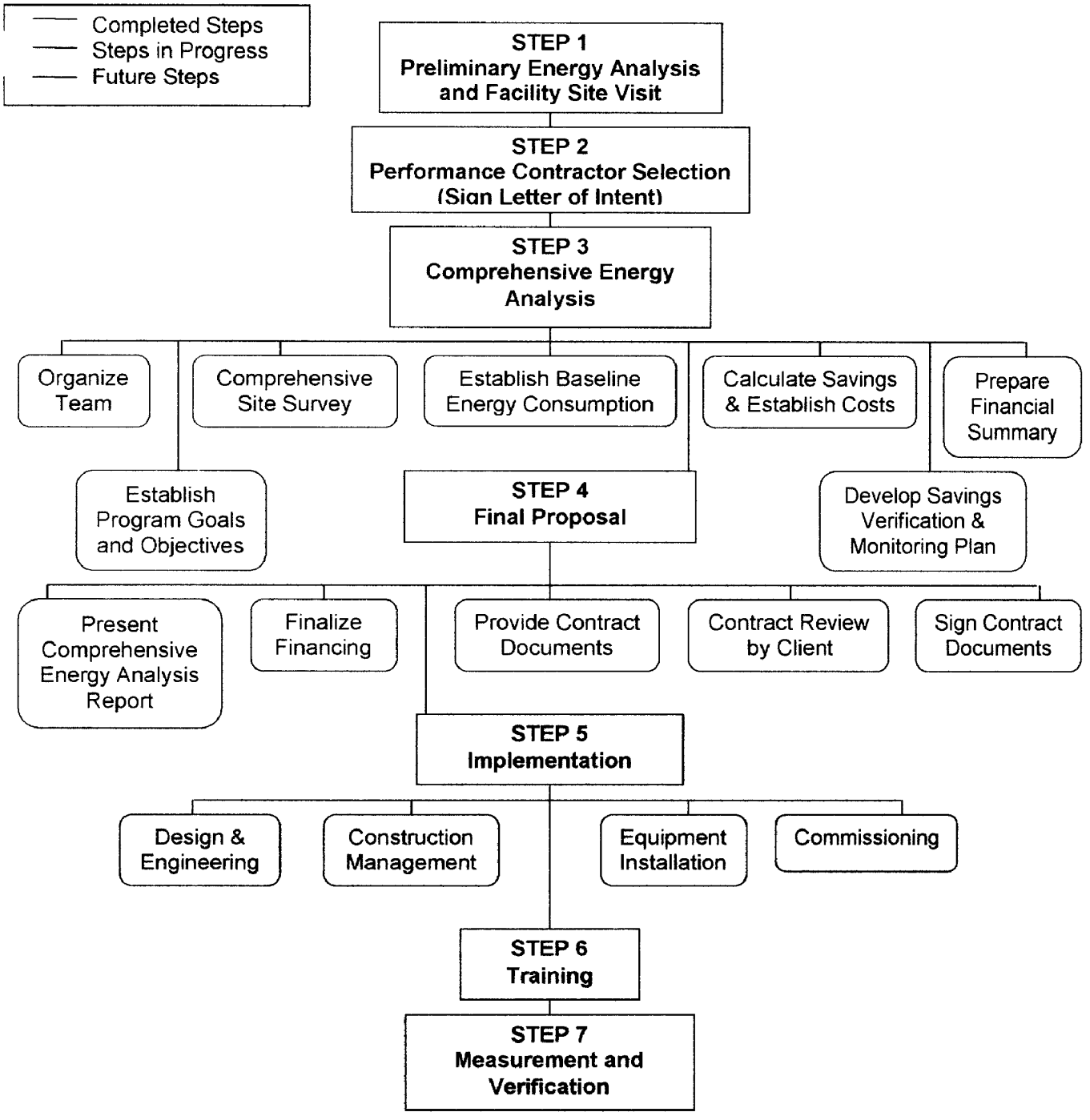
Initial Training

To aid in the implementation of these energy-saving measures, we provide a "people oriented" training program that is guaranteed not to disrupt productivity or create an uncomfortable environment. This program will be tailored to your needs. We have experience in training all levels of staff. Building staff will be trained in energy saving measures within their workspace. We endeavor to change habits within your work force to allow everyone the opportunity to save energy dollars with a program that suits your facility's needs.

Verifying our Success

An important component of this program involves the measurement and verification of the projected performance. After all measures are installed, Energy Masters International will conduct, for a period of one year, a detailed monitoring and verification program to validate the performance of the systems installed and to verify the savings we estimated from baseline conditions. **This program will be funded by the Lodi Electric Utility Department (as part of their contribution to this project) at no cost to the United Congregational Christian Church.**

ENERGY PARTNERSHIP PROGRAM



SECTION TWO
FACILITY PROFILE

Facility Profile

Buildings

The facility consists of (2) buildings; the sanctuary and classroom/fellowship hall structure. The buildings were originally constructed in the 1950's.

The sanctuary consists of a main assembly (pews), a foyer, office, side rooms, and sacristy. A high vaulted ceiling covers the sacristy and the main assembly. The offices and foyer have a low ceiling/flat roof. The sanctuary is approximately 7,800 ft^2 in total area; the assembly/sacristy account for 4,800 ft^2 .

The classroom building is divided into (10) classrooms, a fellowship hall (roughly the size of four classrooms), a storage area, an office, and a central basement mechanical/electrical room. The building has a saw tooth roof design and is connected to the sanctuary by covered walkways. The total building area is approximately 5,940 ft^2 .

Usage Schedule

The sanctuary provides a house of worship for an average of 150 parishioners every Sunday from 10-11am. Special events are rare; occasional concerts and conferences occur only 4 to 5 times a year. Choir practice is held in the sanctuary on Wednesday evenings. The main office is usually occupied during the day.

The classrooms house 30-40 students and teachers (Headstart Program) all year round. The congregation utilizes the fellowship hall for dinners and gatherings of up to 100 people. The nursery and Plymouth rooms are used on Sundays and for special events. The fellowship hall is sometimes used as a polling station and is home once a month to the quilters guild.

BUILDING PROFILE

Lighting Systems

The following table shows the lighting fixture types found at the United Congregational Christian Church:

Lighting Fixture Type		*Quantities*
LOBBY	REC. CAN,1-200 INC.	4
DISPLY	TRK HEADS,1-100 INC.	2
CLOSET	INC, 1-100	1
REAR OFFICE	STRP,2-8'T12, SL,SB	2
RST RMS	INC, 1-100	1
BACK STAGE	STRP,2-8'T12, SL,SB	4
	INC, 1-100	2
EXIT SIGNS	INC,2-40	4
SANCTUARY SOFFET	STRP,2-8'HO	28
STAGE SPOTS	HEADS,1-150	10
STAGE BACK LIGHT	SPOTS,1-300 INC.	9
	STRP,2-8'HO	3
OFFICE	WRP,2-4'T12,SL,SB	6
RST RM	INC. 1-100	3
MECH. RM	INC. 1-100	1
PASTOR'S OFF.	WRP,2-4'T12,SL,SB	6
MECH. RM	INC. 1-100	1
EXTERIOR		0
BREEZE WAY	INC. 1-100	16
BOILER RM	INC.1-150	5
	STRP,2-8'T12, SL,SB	1
CLSS RM WING	JELY JAR,1-100, INC.	7
WALL PAK	WALL PAK,1-500 QRTZ	2
BELL TWR	FLD,1-500 QRTZ	1
RST RMS	INC. 1-100	12
CLASS RMS		0
# 1 & 3	PEND. STRP,2-4'T12,SL,SB	8
RST RM	INC. 1-100	1
# 5,7,9,8,6,4,2	PEND. STRP,2-4'T12,SL,SB	42
#11 FELW HALL & KTCHN	PEND. STRP,2-4'T12,SL,SB	28
	CANS,1-100, INC.	2
EXIT SIGNS	INC,2-20	4
OFFICE	WRP,4-4'T12,SL,SB	1
STORGE	INC, 1-200	2

The existing lighting system is dated T-12 fluorescent and incandescent technology and has not been retrofitted to incorporate current energy efficient lighting measures such as new state-of-the-art electronic ballasts, T-8 and compact fluorescent lamps. A lighting retrofit/conversion throughout the buildings would improve energy efficiency, enhance lighting levels, and reduce maintenance costs. With the additional installation of motion sensors in selected areas such as the offices and classrooms, there would be added energy efficiency savings simply by saving the time associated with lights being left on in rooms that are not being occupied and control of the lighting system during non-business hours. Occupancy sensors will also eliminate manual operation and increase lamp life.

The conversion of these fixtures represents an excellent means to reduce energy costs, while concurrently increasing the quality of the light produced by the fixtures. Not only are these systems more energy efficient, but they produce light that creates a more natural, color-corrected learning, worshiping and working environment.

HVAC & Controls

The central plant's natural gas-fired boiler heats the sanctuary. A closed loop hot water (hydronic) system supplies the (2) vertical air handler's hot water coils. **Note: *The existing hot water supply line has failed and needs replacement.*** The air handlers are housed in mechanical closets on each side of the sanctuary. They provide warm air via an underground duct system to floor mounted grilles located along the length of the building. A 3-way control valve modulates to maintain space temperature and provide constant water flow through the system. The air handler fans are controlled by a twist timer and are manually operated on an as-needed basis.

The central plant heats the classrooms and fellowship hall as well. Each space has a ceiling suspended unit ventilator which provides warm air to the space. Separate packaged rooftop HVAC units provide the cooling. The (6) units provide cool air to the space via individual rooftop ductwork systems. Room thermostats manually control both heating and cooling.

The central mechanical plant consists of (1) a natural gas fired boiler and (2) re-circulating pumps for the hydronic system. The original design for the plant allowed for the future addition of cooling equipment. This type of system, known as a Dual Temperature Water 2-pipe system, is capable of providing either hot or cold water to the air handling systems in the classrooms and sanctuary. This system can be very effective, but is limited by its inability to provide simultaneous heating and cooling and its lengthy, non-producing transition from one mode (heating) to the other (cooling). Since the cooling equipment was never added to the central plant, the sanctuary has no cooling.

SUMMARY - UTILITY EXPENSE HISTORY

The charts that follow summarize the United Congregational Christian Church's utility usage from December of 1998 to November of 1999.

The energy demands for the facility are met through the use of electricity and natural gas. Electricity is provided by the Lodi Electric Utility Department and the natural gas is provided by PG&E. The applicable rate tariffs are G1 and GNR1 respectively.

The average cost for electricity used in this analysis is given in the table below, and addresses those costs accrued for calendar year 1999.

Utility	Usage
Electric Usage	57,646 KWh
Electric Demand	0 KW
Natural Gas	6,634 Therms

The next table reviews the costs and average costs for utility usage over the same period of time as the table above.

Utility	Cost	Average Cost
Electric Usage	$6,662	$0.112 KWh
Electric Demand		0 KW
Natural Gas	$4,274	$0.64 Therms

The following charts illustrate electric and gas usage for the church over the same one-year period.

Figure 1 on the following page shows the cost summary for both natural gas and electricity in table and bar graph format. It also shows key index figures for the facility.

Figure 2 shows the energy consumption history and combines natural gas and electricity into common units of measure. Key indexes are again included.

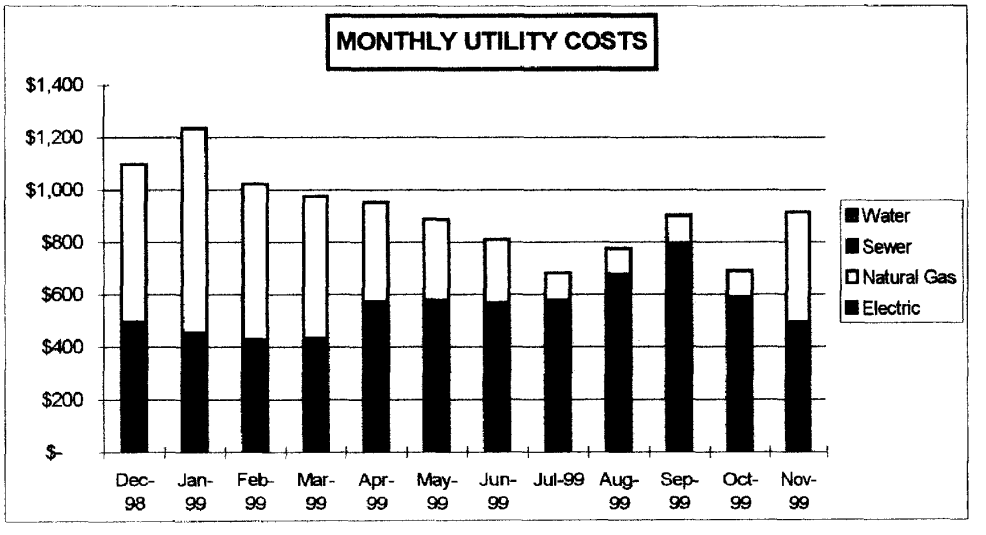
Figure 3 presents the electric use profile in energy units of kWh, Mbtus, and dollars.

Figure 4 shows the natural gas use profile in energy units of therms, Mbtus, and dollars.

First Congregational Christian Church
701 S Hutchins St
Lodi, CA. 95240

COST SUMMARY

Dec-98	$ 602	$ 495	$ -	$ -	$ -	$ 1,097
Jan-99	$ 779	$ 456	$ -	$ -	$ -	$ 1,235
Feb-99	$ 595	$ 427	$ -	$ -	$ -	$ 1,022
Mar-99	$ 543	$ 431	$ -	$ -	$ -	$ 974
Apr-99	$ 379	$ 573	$ -	$ -	$ -	$ 952
May-99	$ 308	$ 578	$ -	$ -	$ -	$ 886
Jun-99	$ 240	$ 569	$ -	$ -	$ -	$ 809
Jul-99	$ 104	$ 578	$ -	$ -	$ -	$ 682
Aug-99	$ 98	$ 677	$ -	$ -	$ -	$ 775
Sep-99	$ 103	$ 797	$ -	$ -	$ -	$ 900
Oct-99	$ 100	$ 589	$ -	$ -	$ -	$ 689
Nov-99	$ 422	$ 491	$ -	$ -	$ -	$ 913

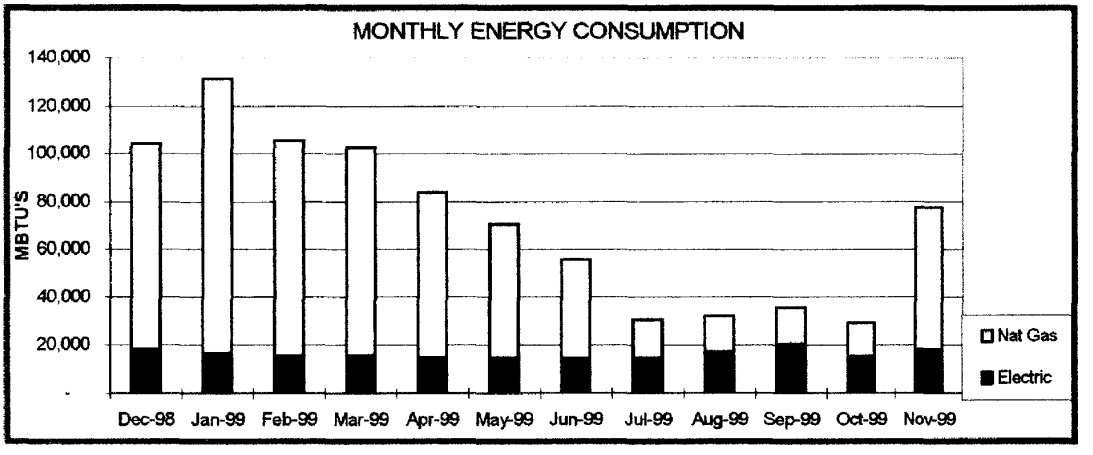


Facility Size	13,740	Square Feet (SF)
Annual Electricity Costs	$ 6,662	61% of Total
Annual Natural Gas Costs	$ 4,274	39% of Total
Annual Water Costs	$ -	0% of Total
Annual Sewer Costs	$ -	0% 13740
Total Annual Costs	$ 10,936	
Annual Electricity Costs	$ 0.48	Per Square Foot
Annual Natural Gas Costs	$ 0.31	Per Square Foot

First Congregational Christian Church
701 S Hutchins St
Lodi, CA 95240

ENERGY SUMMARY

Dec-98	5,360	861		18,288	86,100	104,388	7,597	-
Jan-99	4,920	1,145		16,787	114,500	131,287	9,555	-
Feb-99	4,600	897		15,695	89,700	105,395	7,671	-
Mar-99	4,640	867		15,832	86,700	102,532	7,462	-
Apr-99	4,280	691		14,603	69,100	83,703	6,092	-
May-99	4,320	558		14,740	55,800	70,540	5,134	-
Jun-99	4,246	414		14,487	41,400	55,887	4,067	-
Jul-99	4,320	161		14,740	16,100	30,840	2,245	-
Aug-99	5,080	149		17,333	14,900	32,233	2,346	-
Sep-99	6,000	153		20,472	15,300	35,772	2,603	-
Oct-99	4,560	141		15,559	14,100	29,659	2,159	-
Nov-99	5,320	597		18,152	59,700	77,852	5,666	-

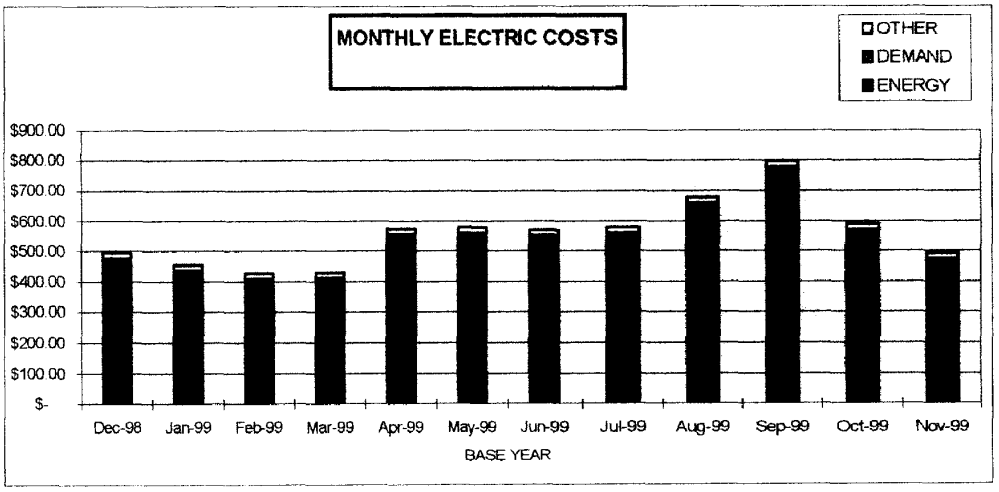


Facility Size	13,740	Square Feet	
Annual Electricity Consumption	4.20	KWH Per Square Foot	
Annual Natural Gas Consumption	0.483	13740	
Other Energy Consumption	-	UNITS Per Square Foot	
Highest Demand Charge (Connected Load)	-	Watts Per Sq Ft	
Annual Electric Energy Intensity	14,315	BTU's Per Sq Ft Per Therm	23%

First Congregational Christian Church
701 S Hutchins St
Lodi, CA. 95240

TYPE: ELECTRIC
RATE; G1

Dec-98	33	5,360	18,288	162	$ 476.45	$ -	$ 18.42	$ 494.87	1,331	$ 0.036
Jan-99	28	4,920	16,787	176	$ 437.34	$ -	$ 18.33	$ 455.67	1,222	$ 0.033
Feb-99	31	4,600	15,695	148	$ 408.89	$ -	$ 18.27	$ 427.16	1,142	$ 0.031
Mar-99	31	4,640	15,832	150	$ 412.45	$ -	$ 18.28	$ 430.73	1,152	$ 0.031
Apr-99	29	4,280	14,603	148	$ 554.99	$ -	$ 18.21	$ 573.20	1,063	$ 0.042
May-99	31	4,320	14,740	139	$ 560.17	$ -	$ 18.21	$ 578.38	1,073	$ 0.042
Jun-99	32	4,246	14,487	133	$ 550.58	$ -	$ 18.20	$ 568.78	1,054	$ 0.041
Jul-99	29	4,320	14,740	149	$ 560.17	$ -	$ 18.21	$ 578.38	1,073	$ 0.042
Aug-99	30	5,080	17,333	169	$ 658.72	$ -	$ 18.37	$ 677.09	1,261	$ 0.049
Sep-99	33	6,000	20,472	182	$ 778.02	$ -	$ 18.55	$ 796.57	1,490	$ 0.058
Oct-99	28	4,560	15,559	163	$ 571.36	$ -	$ 18.09	$ 589.45	1,132	$ 0.043
Nov-99	30	5,320	18,152	177	$ 472.89	$ -	$ 18.41	$ 491.30	1,321	$ 0.036

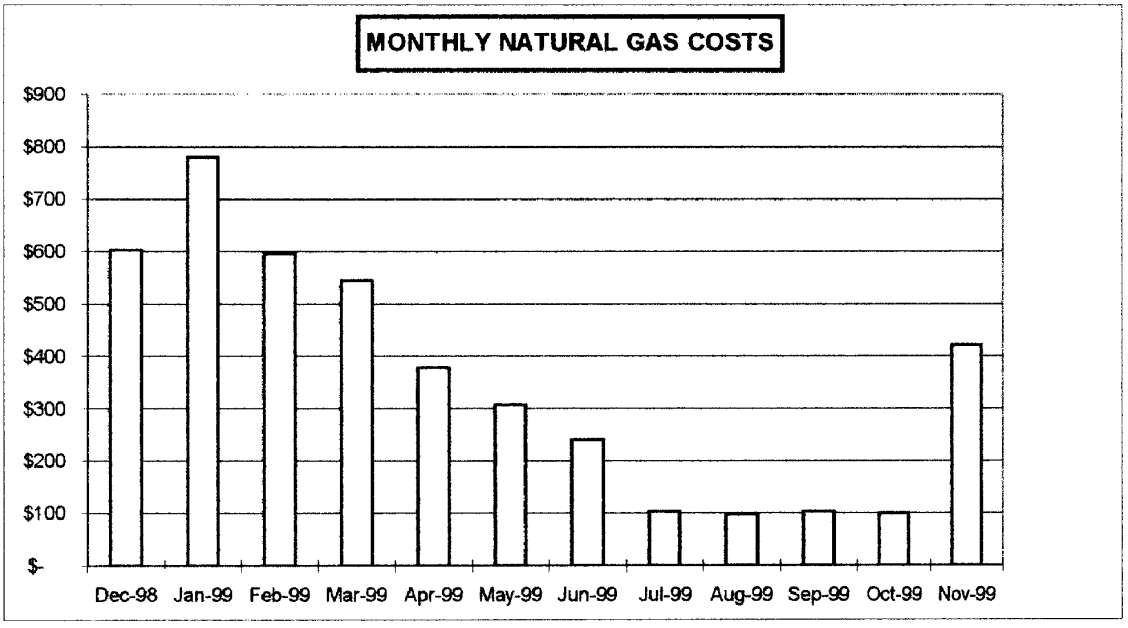


Facility Size	13,740	Square Feet (SF)
Baseline Annual Cost	$ 6,661.58	Annual Total
Annual Electricity Cost	$ 0.4848	Per Square Foot
Average Electric Rate	$ 0.1118	Per KWH
Annual Electricity Consumption	4.20	KWH Per SF
Average Electric Demand Rate	$ -	Per KW
Highest Demand Charge (Connected Load)	Per Therm	Watts Per SF

First Congregational Christian Church
S Hutchins St
Lodi, CA. 95240

TYPE: NATURAL GAS

Dec-98	30	861	86,100	602.37		$ 602	$ 0.70	6,266	$	0.044
Jan-99	33	1,145	114,500	779.38		$ 779	$ 0.68	8,333	$	0.057
Feb-99	30	897	89,700	595.29		$ 595	$ 0.66	6,528	$	0.043
Mar-99	32	867	86,700	543.45		$ 543	$ 0.63	6,310	$	0.040
Apr-99	29	691	69,100	379.09		$ 379	$ 0.55	5,029	$	0.028
May-99	30	558	55,800	308.06		$ 308	$ 0.55	4,061	$	0.022
Jun-99	29	414	41,400	240.31		$ 240	$ 0.58	3,013	$	0.017
Jul-99	32	161	16,100	103.61		$ 104	$ 0.64	1,172	$	0.008
Aug-99	30	149	14,900	98.15		$ 98	$ 0.66	1,084	$	0.007
Sep-99	32	153	15,300	103.12		$ 103	$ 0.67	1,114	$	0.008
Oct-99	30	141	14,100	99.55		$ 100	$ 0.71	1,026	$	0.007
Nov-99	30	597	59,700	421.62		$ 422	$ 0.71	4,345	$	0.031



Facility Size	13,740	Square Feet (SF)
Baseline Annual Cost	$ 4,274	Annual Total
Annual Natural Gas Costs	$ 0.31	Per Square Foot
Average Natural Gas Rate (Includes All Costs)	$ 0.64	Per Therm
Annual Natural Gas Consumption	6,634	Therms
Annual Natural Gas Consumption	0.48	THERM Per SF
Annual Natural Gas Energy Intensity	48,282	BTU's Per SF

Facility End-Use Profile

PROJECT: **First Congregational Christian Church**
LOCATION: 701 S Hutchins St SIZE:
Lodi, CA. 95240

ELECTRIC	$ 6,662	$ 0.48	196,688	14,315
NATURAL GAS	$ 4,274	$ 0.31	663,400	48,282
OTHER	$ -	$ -	-	-

LIGHTING	28%	$ 1,865	34%	$ 634
MECHANICAL	69%	$ 4,596	36%	$ 1,655
MISC	3%	$ 200	0%	$ -

HEATING	82%	$ 3,505	21%	$ 736
HOT WATER	17%	$ 727	0%	$ -
OTHER	1%	$ 43	0%	$ -

SECTION THREE
TECHNICAL ANALYSIS & SCOPE OF WORK

This section provides a description of the systems upgrades and energy savings measures we recommend for each building. Please refer to "Section IV – Financial Summary" for a summary of the costs and associated savings for each of the program components.

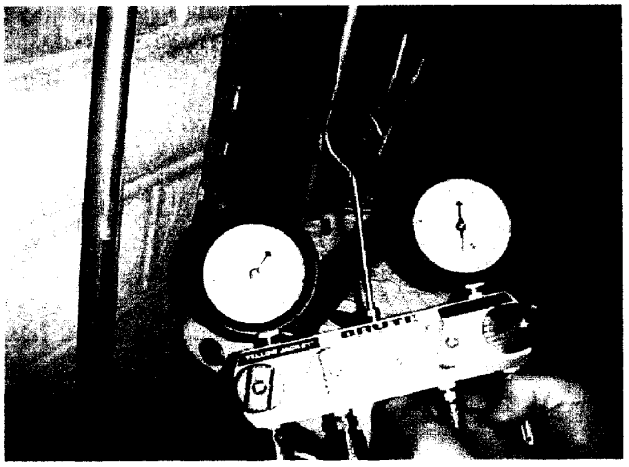
Expressed Facility Needs

The church has expressed a desire to more fully utilize their sanctuary facilities. They plan to add a second Sunday service in 2000. They would also like to attract more use from community groups. However, the lack of air conditioning for the sanctuary imposes a barrier to extended facility use. Outside groups will be reluctant to use the facility during the summer months due to the lack of air conditioning. Congregational use is inhibited as well. For example, the choir does not typically perform during the summer because it is too hot where they are seated.

The controls for the environmental systems are also a concern. They are reported to be too complicated for the staff to use effectively. Since controls are manual, the potential exists for wasted energy by running equipment during unoccupied periods.

In addition, the central boilers as well as the rooftop HVAC units have reached their useful life expectancy. Not only do they operate inefficiently, they will soon experience abject failure, resulting in "emergency" need to replace conditions. Emergency replacement of equipment is more costly and disruptive than planned replacement. Waiting until equipment fails before replacing it also creates a "lost opportunity"; system operational and efficiency improvements are not made because no time is available to thoughtfully design an energy efficient replacement plan and implement it.

As further analysis of the central plant boiler EMI and Air Systems performed a pressure check of the existing hot water supply line to the Sanctuary and found that the lines did not hold pressure, indicating that the lines had failed.



In addition, as part of this analysis, we performed an air balance on the existing sanctuary air handling systems. We discovered that these systems are only moving about 60% of their design airflow. We determined that the air supply restriction is due to dirty coils.

Lighting & Lighting Control Retrofit

The lighting retrofit proposed below will offer many benefits to the church and classroom facilities:

Reduced Energy Consumption	New T8 lamps and electronic ballasts consume half the energy of the existing T12 systems. Occupancy sensors turn off unneeded lights when unoccupied and control unneeded after-hours run time.
Longer Life	New T8 lamps have a rated life span of 20,000 hours – double that of existing T12 lamps.
Better Light Quantity and Quality	T-8 lamps produce the highest lumens per watt and more natural color.
Lower Cooling Load Requirements	Air conditioning equipment run time and energy consumption will be reduced.
Trouble Free Warrantee Service	Energy Masters warrants fluorescent fixtures and T-8 lamps for one year, and electronic ballasts for five-years.
T12 Lamp and Ballast Disposal	The cost of lamp and ballast disposal is included.

The Energy Conservation Measure (ECM) recommendations listed below will result in improved light levels and energy savings in each space throughout the facilities.

ECM Title: Lighting Control Devices

Present Condition: The following locations can be retrofitted with lighting controls to reduce electric energy consumption: Back Stage, Rear Office, Rest Rooms, Offices and Classrooms 1-9.

Modification: Install motion, sound or infrared occupancy sensors in series with or in place of the light control switch as follows:

16 - Wall mounted occupancy sensors
3 - Ceiling mounted occupancy motion sensors

ECM Title: Electronic Ballasts and T-8 Fluorescent Lamp Retrofit/Conversion

Existing lighting components include four-foot and eight-foot fluorescent fixtures with T-12 (4') 34 watt and (8') 123 watt fluorescent lamps. These lamps are driven by standard magnetic ballasts, which, combined with the T-12 fluorescent lamps, contribute to a highly inefficient lighting system.

ECM:

Installation of electronic ballasts and new energy saving 32 watt T-8 lamps will reduce energy consumption and improve the current light level intensities. Electronic ballasts are designed to operate lamps at lower wattage due to the higher frequency provided to the lamps from the ballast. The electronic ballast also operates at a lower temperature than conventional ballasts, which extends ballast life significantly and lowers cooling load requirements.

Spaces to be retrofitted include the following:

- All Offices
- Sanctuary Soffet
- Classrooms
- Meeting Rooms
- Back Stage
- Rest Rooms
- Boiler Room

ECM Title: Compact Fluorescent Conversion

The existing Lobby, Mechanical Rooms, Display Case, Classroom, Rest Rooms, Breeze Way and selected exterior fixtures currently use inefficient high wattage incandescent lamps.

ECM:

The existing fixtures will be converted to high efficiency low wattage compact fluorescent lamps with electronic ballasts.

ECM Title: Exit Lamp Retrofit

The existing exit signs use (2) 20 watt incandescent lamps. Exit lamps are normally illuminated 24 hours per day or 8,760 hours per year and must be visible from a specified distance in accordance with local fire codes.

The exit signs can be retrofitted with a 3 Watt LED (light emitting diode) lamp kit. The kits contain all materials necessary to retrofit each existing exit fixture.

This lamp replacement will provide comparable light output while reducing energy consumption and lamp maintenance. The average rated life of an incandescent lamp is 2,000 hours compared to a rated life of 100,000 hours for the LED lamp kit. With these lower wattage lamps, the fixture will also operate at a cooler temperature.

Spaces to be retrofitted include the following:

- All exit signs in all buildings

In summary, the proposed lighting system retrofits will offer these benefits:

- ✓ Reduced energy consumption and electrical costs
- ✓ Reduced maintenance and replacement costs
- ✓ Extended equipment life
- ✓ Enhanced lighting system performance
- ✓ More comfortable learning, worshiping and work environment.
- ✓ Warranteed, trouble free operation

Trouble Free Service – Our Warranty

Energy Masters International, Inc. and/or its subcontractor warrant the fluorescent lighting systems installed by Energy Masters International, Inc. and/or its subcontractor at the United Congregational Christian Church. The warranty provisions are as follows:

Fluorescent fixtures have a warranty period of ninety days from the date installation is completed. Energy Masters International, Inc. and/or its subcontractor will at no charge including labor, materials, and workmanship repair or replace any energy saving fluorescent lighting fixtures installed as specified in the scope of work contract that fail within a ninety day period. This includes fixtures, lamps, ballasts, end clips and fixture wiring connections.

T-8 lamps have a manufacturers warranty of three years from the date of the installation. Energy Masters international, Inc. and/or its subcontractor, will at no charge including labor, materials, and workmanship repair or replace any energy saving T-8 lamps installed as specified in the scope of work contract that fail within the initial ninety day period. Should the lamps fail anytime after the initial ninety days of installation, the manufacturer will be responsible for lamp replacement.

Electronic ballasts have a manufacturers warranty for five years from the date of installation. Energy Masters International, Inc. and or its subcontractor, will at no charge including labor, materials, and workmanship repair or replace any energy savings electronic ballasts installed as specified in the scope of work contract that fail within the initial ninety day period. Should the ballasts fail anytime after the initial ninety days of installation, the manufacturer will be responsible for ballast replacement.

This warranty covers only those fixtures, wiring and lighting components installed by Energy Masters International, Inc. and/or its subcontractor as specified in the installation contract, and is in addition to any manufacturer's expressed warranties on installed components. Should the church request additional warranty options, EMI will custom design warranties to the requirements and include additional warrantee costs in the project.

PCB Ballast Disposal

All existing PCB ballasts will be removed and properly disposed of in compliance with appropriate laws and regulations. Disposal is included in project cost.

Mechanical System Improvements

In order to provide cost effective air conditioning for the sanctuary it is best to utilize the existing hydronic (closed loop water) system. Since the original design allowed for changing the system into dual water temperature operation, engineering analysis was performed to best determine system modifications. It was determined that the largest cooling unit that could be added to the existing system was a 15 ton air-cooled chiller. This unit must be located outside. The area west of the boiler plant (in the parking lot just in front of the metal sheds) appears to be the most practical location. Hydronic system modifications to allow for the piping interconnections and the addition of changeover control valves will also be required.

In order to improve the ability of the new system to adequately switch from seasonal heating to cooling mode, the classroom heating system would be eliminated from the hydronic loop. This will allow for more efficient operation of the chiller and boiler. Since the modified system will have a smaller heating load, a smaller, more efficient boiler will be installed to replace the existing boiler and **the failed hot water supply lines will be replaced.**

Proper operation of this system will be required in order for the maximum cooling needs to be sufficiently met. A worst case scenario might be an August afternoon wedding with 200 plus people in attendance. Due to the inefficiencies inherent in supplying cool air from floor grilles and the large latent heat load from people, a pre-cooling mode of operation will be required. In fact, pre-cooling for all summer events is highly recommended. Pre-cooling is done by starting the cooling systems 2-4 hours ahead of the anticipated event. In addition, the space temperature is set slightly lower than usual, or than is required. Although the space may seem slightly cool to the occupants when first entering, the space will quickly warm up from large number of people present. Space temperature will glide slightly during the 1-2 hour event, but will remain comfortable. Without pre-cooling, the existing hydronic system would not be large enough to satisfy extreme short periods of maximum cooling demand.

Additional upgrades and maintenance improvements to the hydronic system will also include resizing and replacing the re-circulating pump, checking existing valves for proper operation, checking for leaks, flushing and treating the entire closed loop water and cleaning the existing coils system.

Controls

A new automated temperature control system will be required for the dual temperature water system to operate efficiently. To simplify environmental control for the sanctuary, a central interface point for the control system should be provided to simplify scheduling and temperature adjustments. It is recommended that an override button be accessible to church staff so that the sanctuary heating/cooling system can be operated any time for limited periods. Church staff will also be able to adjust space temperature for the sanctuary during these override periods. Since pre-cooling is more complicated, it is recommended that three to four event categories be created for pre-cooling strategies. In order for the church to initiate a typical event, a schedule or telephone call can be made to a 24-hour service center with modem access to the control system. The service center will then automatically program the system to operate according to the scheduled event. This type of system control will require a maintenance contract with a control/service company as well as installation of a dedicated telephone line for the control system.

The classrooms and fellowship hall will need a new heating system. Since the ductwork has to be replaced for the impending re-roofing and the existing cooling-only units need to be replaced as well, the most efficient remodel will be to install new rooftop Heat Pump units capable of both heating and cooling the space. These units will be provided with electronic programmable controls to provide ease of use and yet restrain equipment runtime during unoccupied periods.

Roof Replacement

The church is considering replacement of the roof over the classrooms and flat areas of the walkways and sanctuary. The new roof is being considered because of the deteriorating conditions of the current roof and the resulting costly repair bills. Integrating the roof replacement with the mechanical and electrical project will provide for proper coordination between the trades and help minimize multiple points of contact for construction.

Two roofing contractors have visited the facility and have tendered proposals for the work. The table on the following page (Table 1) shows how the roofing proposals compare to each other.

Our initial recommendation is for option 2 from Alpine Construction. Please note that the proposals explicitly warn that dry rot damage may be present and that the required repair of such damage is not covered in the proposal. Additional costs for dry rot repair must be allowed for when budgeting money for this project.

United Congregational Christian Church
ROOFING PROPOSALS
COMPARISON TABLE

Description	Alpine opt 1	Alpine opt 2	Alpine opt 3	Bechthold opt 1
Remove existing roof and inspect	Included	Included	Included	Included
Repair any dry rot uncovered	Extra cost	Extra cost	Extra cost	Extra cost
Install plywood crickets over flat deck to allow water to properly drain (160 ft2)	Included	Included	Included	NOT INCLUDED
Install (32) metal pitch pockets for flat deck in front of sanctuary	Included	Included	Included	NOT INCLUDED
ROOF TYPE AT SAW TOOTHS	Fiberglass Roof Shingles	Same	Duro-Last Fire Retardant Reinforced Thermoplastic Membrane Roof System	Mineral 4ply Fiberglass System
Underlayment	30lb felt	Same	----------	----------
Attachment method	Nails; Specifically, No Staples	Same	----------	----------
ROOF TYPE AT FLAT, VALLEY, & TURN UP AREAS	Mineral 4ply Fiberglass System	4ply Modified Fiberglass System	Duro-Last Fire Retardant Reinforced Thermoplastic Membrane Roof System	Mineral 4ply Fiberglass System
1st ply	Nail-on Fiberglass Base Sheet	Nail-on Perma Glass Ultra Base Fiberglass	Single Ply Membrane	Nail-on Fiberglass Base Sheet
2nd ply	Intermediate Fiberglass Sheet	Perma Glass Ultra Ply VI	None req.	Fiberglass Ply IV
3rd ply	Intermediate Fiberglass Sheet	Perma Glass Ultra Ply VI	None req.	Fiberglass Ply IV
4th ply	Cf Mineral Surfaced Cap Sheet	Brai/Flex 170 – Heavy Duty Mineral Surfaced SBS Modified Asphalt Membrane	None req.	72lb Granulate (white) Cap Sheet
Installation method	Bonded Together	Not Specified	Computer Aided Drawing of Roof Sent to Mfgr. Roof Manufactured at Factory	Not Specified
Asphalt type	Hot Mopped	Hot Mopped	None req.	Hot Mopped
Asphalt rate	25lbs per 100 ft2	25lbs per 100 ft2	----------	25lbs per 100 ft2
Roof penetration treatment	None	Additional Layer of Flex 170/Flashing	Vinyl Duro Last product Mech. Fastened. Boots are Custom Fitted	Not specified
Manufacturer Warranty	25 Years – Material Defect	25 Years – Material Defect	15 Years for Repairs/Replacements	Not specified
Labor Warranty	4 Years	4 Years	2 Years	5 Years
Price	$30,408.00	$32,868.00	$38,988.00	$40,699.00
Alternate 30 Yr Warranty	Add $1,214.00	Add $1,214.00	-----	
Alternate 40 Yr Warranty	Add $2,720.00	Add $2,720.00	-----	
Cost Difference	---	$2,460.00	$8,580.00	$10,291.00
Payment Terms				50% When Materials Arrive

Energy Analysis of Proposed Scope of Work

It is important to define "cost avoidance". Due to the fact that the project will be adding additional energy consumption for cooling the sanctuary and the anticipated increase in usage of the facilities in general, the actual energy consumption and costs compared to previous years may not decrease. In fact, the energy consumption may increase because of increased usage in the summer months. However, how much higher would the energy costs have been if energy efficient design was not utilized? Cost avoidance is the appropriate comparison of what it would cost to utilize the existing equipment, with the addition of standard efficient air conditioning for the sanctuary, versus the proposed energy efficient design to meet the expanded usage needs. Had the church gone forward with emergency and minimum first-cost replacement of the central plant boiler and expanded the usage of the facilities, they would have experienced energy costs 28% higher than it would take to operate the proposed efficient systems. However, because these energy and operational improvements are being considered for installation, its reasonable to estimate that there will be savings generated from these comprehensive efficiency upgrades when installed.

Highlights of the proposed energy efficient design:

- New heat pump rooftop units for the classroom wing with SEER ratings greater than 12.
- Removal of all existing heating hot water fan coil units in the classroom wing.
- High efficiency hot water boiler – up to 85% efficient.
- Replacement of the failed hot water supply lines to the Sanctuary.
- Reconditioning of the HVAC unit for the Plymouth room and installation of a heat strip.
- Cleaning of the existing air handler coils in the Sanctuary.
- Automated temperature control system with simple user interface. EMS capable, including pre-cooling strategies for Dual Temperature Water System.
- Dual temperature water system with automatic changeover.
- Properly sized heating/cooling equipment.
- New rooftop ductwork lined with insulation.
- New energy-efficient, air-cooled chiller.
- Newly commissioned systems, operating at design performance.
- (3) year preventive maintenance and remote monitoring services for all HVAC equipment and temperature controls.

SECTION FOUR
FINANCIAL SUMMARY

Energy Masters has performed a Comprehensive Energy Analysis of the UCCC and has identified several energy saving opportunities which, when implemented, will result in significant utility cost savings. Table 1 shows the existing utility cost, the retrofit and the associated savings. These figures represent a reduction in utility cost of **21 percent.**

Table 1

Energy Savings Summary	Existing	Potential Avoidance
Annual Electric Usage (kWh)	57,018	17,052
Natural Gas Usage (Therms)	6,634	1,006
Estimated Utility Costs ($)	10,936	2,289

The scope of work to be included in the Energy Partnership Program will represent a comprehensive package of Energy Conservation Measures (ECMs) with financial paybacks.

ECMs:

Sanctuary

1. New energy efficient 15-ton chiller to provide A/C for the sanctuary.
2. New energy efficient heating hot water boiler - up to 85% efficient.
3. New energy efficient re-circulating pump.
4. Repair/Clean existing fan coils.
5. Re-design hydronic system to a dual temperature water system and replace failed hot water supply lines.
6. New automated temperature control system.
7. New T-8 lamps, electronic ballasts, and automated lighting controls.
8. Commission new systems for optimum operation.
9. (3) year preventative maintenance and supervised facilities monitoring program.

Classrooms

1. New rooftop heat pump units with SEER rating greater than 12.

2. New HVAC controls.

3. Recondition existing HVAC unit for Plymouth room; install new heat strip and programmable controls.

4. New T-8 lamps, electronic ballasts, and lighting controls.

5. Commission new systems for optimum operation.

6. (3) year preventative maintenance and supervised facilities monitoring program.

The following summary reflects the cost breakdown for the UCCC Facility Improvement and Energy Efficiency program.

All project costs shown below are complete turn key installation costs. Included are all project management, construction management, program administration, rebate coordination, contingency and disposal. Not included are city permits or fees, and dedicated data-grade phone line for automated temperature controls system supervised monitoring services.

SECTION FIVE – ABOUT ENERGY MASTERS INTERNATIONAL

Energy Masters International is a wholly owned subsidiary of Northern States Power Company (NSP), a forward thinking investor owned utility headquartered in Minneapolis with annual revenues in excess of $2.5 billion and assets exceeding $5 billion. Active in 39 states, Energy Masters has completed over 1,000 comprehensive energy projects, encompassing 125 million square feet in several thousand buildings across the country. In the lighting arena, we have completed upgrades in over a half billion square feet of office, commercial and manufacturing space.

NSP is also the parent company of our sister agency, NRG Energy, which is one of the largest thermal providers of energy in the U.S. In addition to owning and operating the district cooling and heating plants in San Francisco, Pittsburgh, San Diego and Minneapolis, NRG is among the largest independent power producers in the world.

With over 23 years in the energy field, the Federal Government has recognized Energy masters International as a leading energy services firm. We hold the classification of "Super ESPC," one of the highest honors conveyed to private firms by the government and are among a select group of firms that are pre-authorized to complete work in government facilities across the country.

Energy Masters International has performed successfully in the national corporate facilities of such well-known firms as:

Home Savings	Pizza Hut	First National Bank
AT&T	Mobil Oil	Capital Federal Savings
Sheraton Hotels	Federal GSA	US Postal Service
Prudential Insurance	Domino's Pizza	National Semiconductor
Target Stores	3M	United Parcel Service
Sears	HB Fuller	

Further, local corporate facilities for which EMI has performed and provided services include:

Wallace Computer Services, Inc.
City of Lodi, Municipal Buildings
Twin Arbors Athletic Club
Fairmont Signs, Inc.
Bank of Lodi

PARKER HOT WATER BOILER

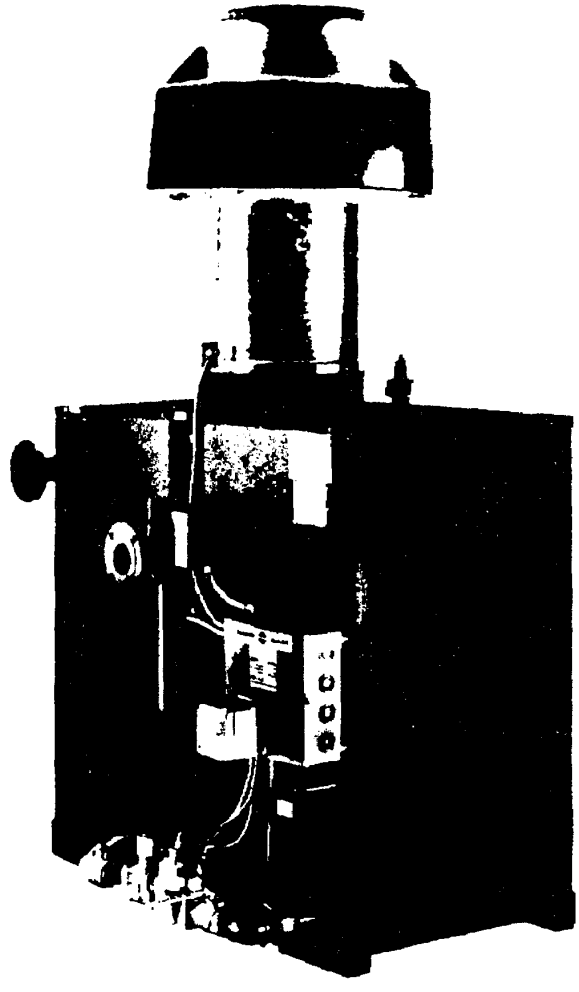
HIGH EFFICIENCY DIRECT FIRED HOT WATER BOILER

Atmospheric or Premix Low NOx Parker "R" Models

300,000 to 2,160,000 BTU Gas Fired

Bent Steel Tube Construction
Introducing a new line of Hot Water Boilers incorporating a built-in finned steel tube bundle in addition to the standard boiler tubes. These heavy duty finned tubes are placed above the standard Parker tubes, and they significantly increase the amount of heat absorbed from the flue gases, thus increasing boiler efficiency.

With the additional heating surface, the already long Parker Hot Water Boiler life is extended even further. The efficiency with Atmospheric Burner firing is 82 - 84%, and with our Premix Metal Fiber Low NOx Burner the efficiency is 85%. Test units have been in the field under harsh conditions operating successfully for 5 years.



High Efficiency
Direct Fired
Hot Water Boiler
300,000 to
2,160,000 BTU Input
Temperatures to 350°F
Pressures to 250 PSI

ADVANTAGES

1. Large Heating Surface
A large amount of heating surface provides increased efficiency, long boiler life and minimizes chances of scaling.

2. Simplicity
The design of the boiler and control system is such that the boiler can be easily operated, maintained and repaired by regular personnel. On atmospheric units simplicity is a decided advantage as there are no complicated controls, blowers, or burner air adjustments.

3. Codes
All Parker Direct Fired Boilers are manufactured in accordance with the ASME Power & Heating Boiler Codes and registered with the National Board of Boiler and Pressure Vessel Inspectors.

Natural gas and LPG fired models are ETL Listed "Industrial and Commercial Gas Fired Packaged Boilers" certified to UL795, for indoor or outdoor service. Canadian models are C-ETL Listed.

PARKER BOILER CO.
NEVER A COMPROMISE FOR QUALITY OR SAFETY

5930 Bandini Boulevard
Los Angeles CA 90040-2998
Fax (213) 722-2848
Phone (213) 727-9800

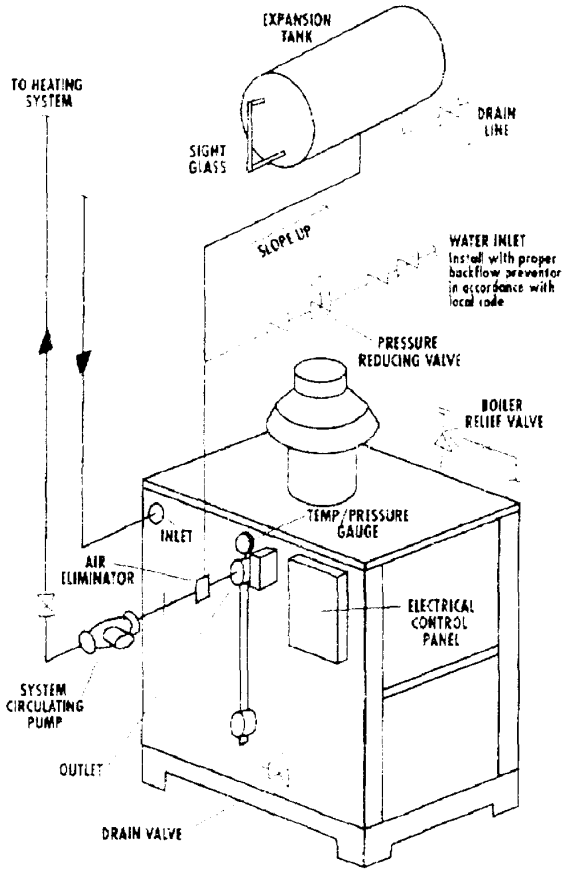
HIGH EFFICIENCY DIRECT FIRED HOT WATER BOILER

Atmospheric or Premix Low NOx Parker "R" Models

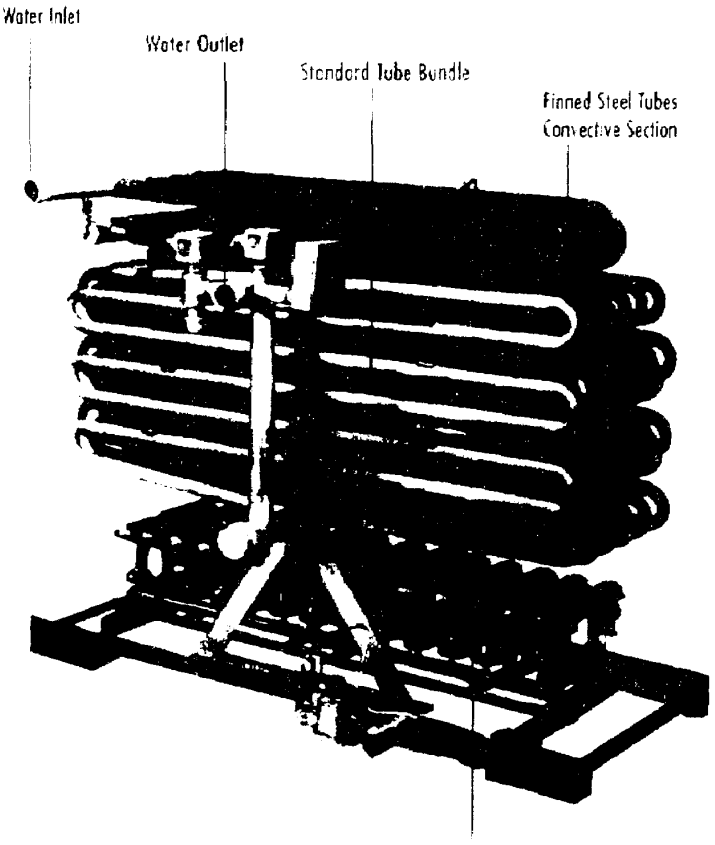
300,000 to 2,160,000 BTU Gas Fired

PARKER HOT WATER BOILER

Typical Single Boiler Hot Water Piping System
(for temperatures 200°F & below)



Parker Atmospheric "R" Model



Atmospheric Low Pressure Gas Burners provide highly effective & uniform heat distribution

4. Heavy Welded Flexible Tube Construction
The Parker steel tube bundle is 13/16" OD (.133") thick, and the finned tubes are 1" OD (.11"), heavy thickness steel. The welded bent tube design permits free expansion and contraction of each tube independently when subject to thermal shocking. Our design eliminates strain on the metal, warping and leaking, typical of rigid straight tube designs. This construction utilizes heavy material with flexibility to provide extreme safety and long life.

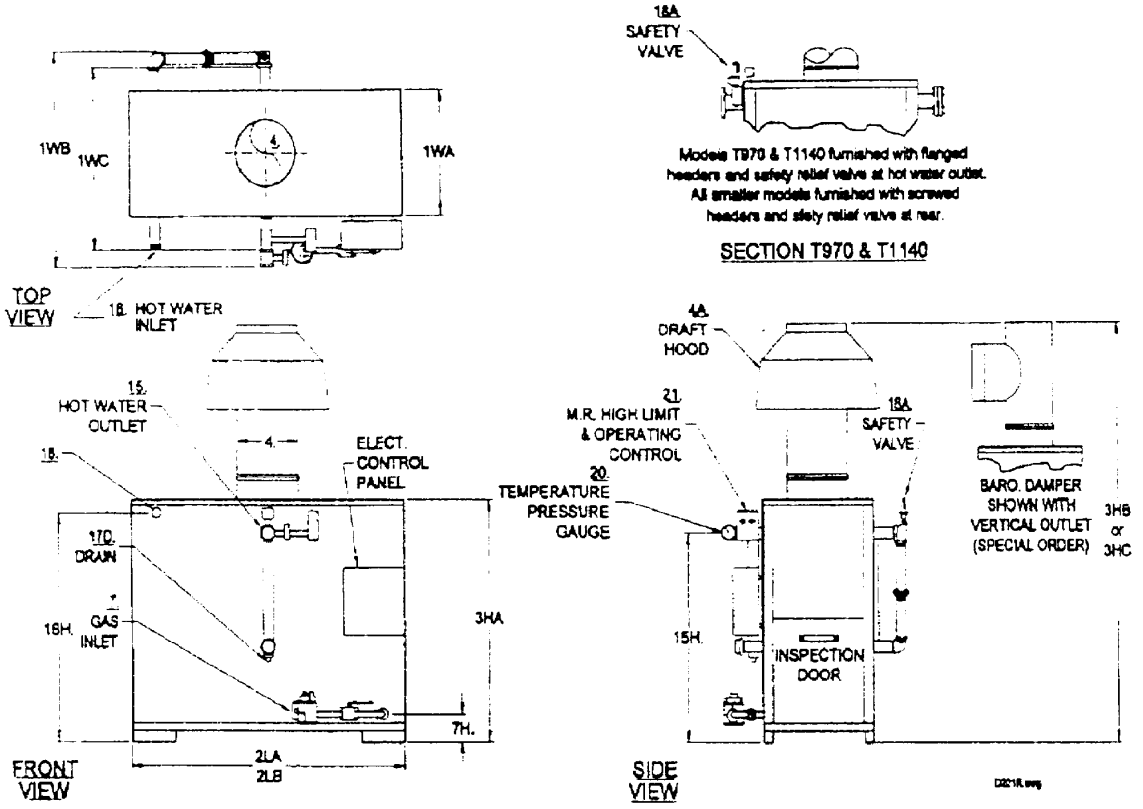
5. Heavy Insulated Cabinet
The cabinet is durably constructed with two thicknesses of heavy steel, insulated on all sides with high temperature thermal fiber insulation to effectively reduce heat losses to a minimum.

THE PARKER DESIGN
A time proven product backed by one of the largest and most successful manufacturers of packaged boilers whose name is synonymous with quality and safety. Every boiler is thoroughly factory fire tested and is required to meet the highest standards in all phases of mechanical and operating efficiency before shipment.

5930 Bandini Boulevard
Los Angeles CA 90040-2998
Fax (213) 722-2848
Phone (213) 727-9800

PARKER BOILER CO.

PARKER DIRECT FIRED HOT WATER BOILER SPEC. SHEET D-201R-I
T300R TO T1140R - ATMOSPHERIC GAS FIRED W/ FINNED CONVECTIVE SECTION 7C



NO.		MODEL NO.	T300R	T395R	T490R	T600R	T760R	T970R	T1140R
A	BTU Input	1000's BTU/HR.	300	395	490	600	760	970	1140
B	BTU Output (82%)	1000's BTU/HR.	246	324	402	492	623	795	935
C	Heating Surface	SQ. FT.	68.5	104	104	114	175	203	217
1WA	Width of Cabinet Only	IN.	16	22	22	22	22	26	26
1WB	Width Overall Including Controls	IN.	34	40	40	40	41	44	54
1WC	Minimum Header Width - Less Fittings (Blind Flanges on T970 & T1140)	IN.	28	34	34	34	34	41	41
2LA	Length of Cabinet Only	IN.	39	35	35	40	54	49	54
2LB	Length Overall	IN.	39	35	35	40	54	49	54
3HA	Height of Cabinet Only	IN.	46	51	51	51	51	51	51
3HB	Height Overall Including Draft Hood(s) (Standard)	IN.	75	82	82	83	84	86	90
3HC	Ht. Overall Inclu. Baro. Damper (Vert. Outlet/Horizt. Outlet) - (Spec. Order)	IN.	64/62	69/67	69/67	69/67	72/69	76/72	76/72
4A	Vent Stack Diameter with Draft Hood (Standard)	IN.	8	10	10	12	12	14	16
4B	Vent Stack Diameter with Barometric Damper (Special Order)	IN.	8	8	8	8	10	12	12
7A	Std. Nat. Gas Inlet Size	IN.	3/4	3/4	1	1	1	1-1/2	1-1/2
7A1	Std. Nat. Gas Inlet Supply Press: Max. 14" WC; Min. 7" WC	IN. WC	7	7	7	7	7	7	7
7A2	Manifold Pressure at Burner	IN. WC	4	4	4	4	4	4	4
7B	Hi Press. Nat. & Propane Gas Inlet Size/Supply Press. 1-5 PSI	IN.	3/4	3/4	3/4	3/4	3/4	1-1/2	1-1/2
7B2	Propane Manifold Press. at Burner	IN. WC	18	18	18	18	18	18	18
7H	Gas Inlet Height From Floor	IN.	6	5	5	5	5	5	5
15	Hot Water Outlet Size *(NPT Except T970 & T1140 Class 150 Flanged)	IN.	1-1/2	2	2	2	2	3*	3*
15H	Hot Water Outlet Height From Floor	IN.	32	37	37	37	37	37	37
16	Water Inlet Size *(NPT Except T1140 Class 150 Flanged)	IN.	2	2	2	2	2	2	2.5*
16H	Water Inlet Height From Floor	IN.	39	44	44	44	44	44	44
17D	Drain Opening(s) (T970 & T1140 1" Inlet Side of Boiler)	Outlet Side IN.	3/4	1	1	1	1	1	1-1/4
18AHP	Safety Relief Valve Drain Size- 125 PSI, 250°F. "H" Code	OUTLET IN.	3/4	3/4	3/4	3/4	3/4	3/4	1
18ALP	Safety Relief Valve Drain Size- 30 PSI, 250°F "H" Code	OUTLET IN.	3/4	1-1/4	1-1/4	1-1/4	1-1/2	1-1/2	2
	Water Capacity	GAL.	6.5	10	10	11	16	19	21
	Net Weight of Boiler	LBS.	590	960	960	1150	1390	1565	1750
	Domestic Crated Shipping Weight of Boiler	LBS.	690	1085	1085	1286	1540	1720	1910

MINIMUM LISTED CLEARANCES TO COMBUSTIBLE CONSTRUCTION	12" Cabinet Sides & Rear	48" Cabinet Top	6" Draft Hood Vent Connector	12" Baro. Damper Chimney Connector

Recommended Clearances for Access: Inspection Doors 18"; Controls 24"; Electrical Panel 30"; Additional Space may be required by Local Codes

Note: All of the above dimensions are for a standard trim model. Due to continuous improvement specifications are subject to change without notice.

TRANE

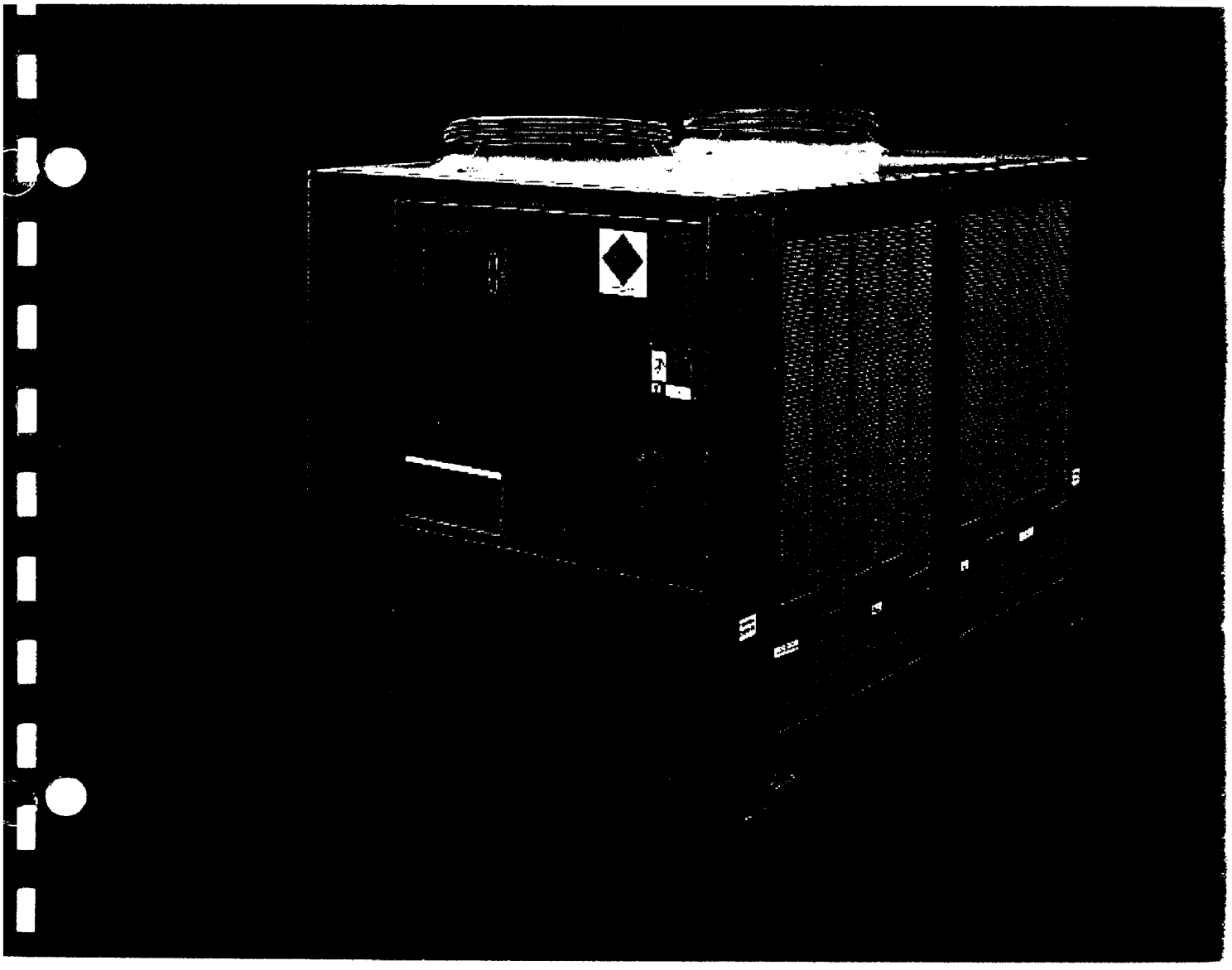
CG-DS-1
July 1997
First Printing - August 1997

CG-DS-1

Air-Cooled Liquid Chillers

10 and 15 Tons Air-Cooled Chillers

20 Through 60 Tons IntelliPak® Air-Cooled Chillers



Features and Benefits

10, 15 Tons

In addition to the many standard features of the 10 and 15-ton air cooled Cold Generator® chiller, there are several added benefits which make selection, installation, and service easier.

Flexibility

Footprint

Central to the design of any project is the operating envelope of the air-cooled packaged chiller. With this in mind, Trane builds the chillers to make the most efficient use of the available installation space. The Trane CGA model chillers are extremely compact. They have the lightest weight, the smallest footprint, and the lowest silhouette of any chiller in the industry.

Weight Reduction

The weight of the 10 and 15-ton units has been reduced up to 27 percent in comparison to previous models. Less weight results in less stress on building supports and greater handling ease.

Installation

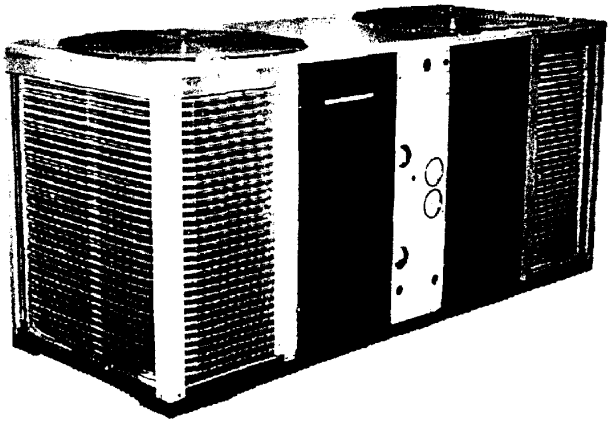
Installation time and effort are reduced when dealing with a significantly smaller and lighter unit. In addition, having electrical and water connections on the same side of the unit and a single-point main power connection serves to make installation easier. The unit arrives at the jobsite fully assembled, tested, charged and ready to provide chilled water.

Serviceability

The control panel and unit panels are completely removable for service accessibility and convenience.

ICS Interface

Communication with Trane Tracer® or Tracker® is possible through the ICS Interface on the 10 and 15 ton Cold Generator chiller..



Optional Features

- **Hot Gas Bypass** — Allows unit operation below the minimum step of unloading.
- **Low Ambient Head Pressure Control** — Modulates the rpm of the fan motor in response to outdoor ambient temperature and unit head pressure. Provides unit cooling operation down to outdoor temperatures of 0°F.
- **Coil Guard** — Metal grille with PVC coating to protect the condenser coil.
- **Isolation** — Neoprene in shear or spring flex isolators.
- **Power Supply Monitor** — Provides protection against phase loss, phase reversal, phase imbalance, incorrect phase sequence and low line voltage.
- **Elapsed Time Meter/Number Starts Counter** — Records number of compressor starts and operating hours.
- **Flow Switch** — Required as a safety interlock to prevent operation of unit without evaporator flow (available option for field installation only).
- **Integrated Comfort™ Systems (ICS) Interface** — Provides the ability to communicate with Trane Tracer® or Tracker® building management systems via a Thermostat Control Module — (TCM).
- **Gauges** — Monitor suction and discharge pressures.

TRANE™

Model Number Description

10, 15 Tons

CGA	120	B	3	00	B	A
123	456	7	8	9,10	11	12

DIGIT 1,2,3 — Unit Type
CGA = Air-Cooled Cold Generator®

DIGITS 4,5,6 — Nominal Capacity(MBH)
100 = 8 Tons (50 Hz Model only)
120 = 10 Tons (60 Hz Model only)
150 = 12.5 Tons (50 Hz Model Only)
180 = 15 Tons (60 Hz Model Only)

DIGIT 7 — Major Design Change
Number of Refrigerant Circuits/Number of Compressors)
B = 2 Refrigerant Circuits/2 Compressors

DIGIT 8 — Voltage
1 = 208-230/60/1
(Available — CGA120 Only)
3 = 208-230/60/3
4 = 460/60/3
W = 575/60/3
D = 380-415/50/3

DIGIT 9 — Factory Installed Options
0 = No Options
H = Hot Gas Bypass
C = Black Epoxy Coil Standard Deviation
K = Hot Gas Bypass & Black Epoxy Coil
S = Special

DIGIT 10 — Leaving Solution Setpoint
D = Standard Expansion Valve
40-60°F Leaving Water
(CGA100 & CGA120 models)
20-60°F Leaving Solution
(CGA150 & CGA180 Models)
V = Nonstandard Expansion Valve
20-39°F Leaving Solution (CGA100 & CGA120 models)

DIGIT 11 — Minor Design Change
A = First, B = Second, etc.

DIGIT 12 —Service Digit

20-60 Tons

2G	A	F	C40	4	A	A	A	1	A
1 2	3	4	567	8	9	10	11	12	13

DIGIT 1,2 — Unit Model
2G = IntelliPak® Air-Cooled Chiller

DIGIT 3 — Unit Type
A = Air-Cooled Condensing

DIGIT 4 — Development Sequence
F = Sixth

DIGIT 5,6,7 — Nominal Capacity
020 = 20 Tons
025 = 25 Tons
030 = 30 Tons
040 = 40 Tons
050 = 50 Tons
060 = 60 Tons

DIGIT 8 — Voltage & Start Characteristics
E = 200/60/3 XL
F = 230/60/3 XL
G = 460/60/3 XL
H = 575/60/3 XL
J = 380/50/3 XL
K = 415/50/3 XL
S = Special

DIGIT 9 — Factory Input
A = Standard

DIGIT 10 — Design Sequence
A = First
B = Second
etc...

DIGIT 11 — Leaving Solution Setpoint
A = 40-50 Deg. F w/o Ice Machine
B = 30-39 Deg. F w/o Ice Machine
D = 51-65 Deg. F w/o Ice Machine
E = 20-29 Deg. F w/o Ice Machine
F = 40-50 Deg. F with Ice Machine
G = 30-39 Deg. F with Ice Machine
H = 51-65 Deg. F with Ice Machine
J = 20-29 Deg. F with Ice Machine
S = Special

DIGIT 12 — Agency Approval
C = UL/CSA
N = None

DIGIT 13 — Miscellaneous
A = Trane Communication Interface (TCI) Module
B = No Unit Heat Tape (50 Hz Only)
C = Compressor Current Sensing (CSM)
D = Unit Mounted Disconnect Switch (Fuse)
E = Unit Isolators Neoprene
F = Unit Isolators Spring
G = Superheat/Sub-Cooling
H = Hot Gas Bypass
J = Generic B A S Module (0-5 v Input, Binary Output)
K = Remote Human Interface
L = Generic B A S Module (0-10 v Analog)
M = Remote Setpoint Potentiometer
P = Zone Sensor — Chilled Solution Reset
R = Phase/Voltage Monitoring
S = Flow Switch
T = Copper Fin Condenser Coils
V = Electronic Low Ambient Damper(s)
X = Inter-Processor Communication Bridge (IPCB)
Z = Packed Stock Unit

The following items can be ordered for separate shipment —
Unit Isolators — Neoprene*
Unit Isolators — Spring*
Flow Switch
Electronic Low Ambient Damper(s)
Trane Communication Interface Module (TCI)
Generic B A S Module (GBAS)
(0-5 volt Analog Input/Binary Output)
Generic B A S Module (GBAS)
(0-10 volt Analog Input/Output)
Remote Human Interface
Remote Setpoint Potentiometer
Zone Sensor (Chilled Solution Reset)
Inter-Processor Communication Bridge (IPCB)
*Unit size must be specified when ordering this item.

TRANE™

General Data

Table 9-1 — General Data — 10-60 Ton Units

Model Number	10 Ton CGA120	15 Ton CGA180	20 Ton CGAF-C20	25 Ton CGAF-C25	30 Ton CGAF-C30	40 Ton CGAF-C40	50 Ton CGAF-C50	60 Ton CGAF-C60
Compressor Data								
Model	Climatuff®	Trane H	Scroll	Scroll	Scroll	Scroll	Scroll	Scroll
Quantity	2	2	2	1/1	2	4	2/2	4
Nominal Tons per Compressor	5	7.5	10	10/15	15	10	10/15	15
Evaporator								
Nominal Size (Tons)	10	15	20	25	30	40	50	60
Water Storage Capacity (Gallons)[2]	1.4	1.5	11.7	10.7	16.3	13.8	21.0	37.8
Min. Flow Rate (GPM)	12.0	18.0	24	30	36	48	60	72
Max. Flow Rate (GPM)	36.0	54.0	72	90	108	144	180	216
Max EWT At Start-Up — Deg F[3]	100	100	108	108	108	108	108	108
Condenser								
Nominal Size (Tons)	10	15	20	25	30	40	50	60
Number of Coils	1	2	1	2	2	2	2	2
Coil Size (ea., Inches)[4]	28 x 108	28 x 83	61 x 71	45 x 71/35 x 71	56 x 70	56 x 70	57 x 96	57 x 96
Number of Rows	2	2	3	3	3	3	3	4
Subcooler Size (ea., Inches)	4 x 108	4 x 83	10 x 71	14 x 71	9 x 70	9 x 70	9 x 96	9 x 96
Condenser Fans								
Quantity	1	2	2	3	4	4	6	6
Diameter (Inches)	28	26	26	26	26	26	26	26
CFM (Total)	8,120	11,600	15,000	21,650	29,200	29,200	42,300	40,700
Nominal RPM	1100	1100	1140	1140	1140	1140	1140	1140
Tip Speed (Ft/Min)	8060	7490	7750	7750	7750	7750	7750	7750
Motor HP (ea.)	1	1/2	1.0	1.0	1.0	1.0	1.0	1.0
Drive Type	Direct	Direct	Direct	Direct	Direct	Direct	Direct	Direct
Minimum Outdoor Air Temperature Permissible For Mechanical Cooling[1]								
Standard Ambient Control Unit (°F)	50	45	30	30	30	30	30	30
Standard Ambient w/Hot Gas Bypass (°F)	60	60	40	40	40	40	40	40
Low Ambient Option (°F)	0	0	0	0	0	0	0	0
Low Ambient Control w/Hot Gas Bypass (°F)	15	15	10	10	10	10	10	10
General Unit								
Unload Steps	100-50	100-50	100-50	100-60-40	100-50	100-75-50-25	100-80-60-30	100-75-50-25
No. of Independent Refrig. Circuits	2	2	1	1	1	2	2	2
Refrigerant Charge (lbs. R22/Circuit)	9.5	12.4	40.5	54.0	72.0	38.0	47.0	67.0
Oil Charge (Pints/Circuit)	4.2	7.5	8.0	8.0/14.0	14.0	8.0	8.0/14.0	14.0

*Unloading steps depend upon which compressor is lead compressor.

Notes:

(1) Minimum start-up ambient based on unit at minimum step of unloading and a 5 mph wind across the condenser.

(2) Includes piping internal to chiller.

(3) At 95°F ambient.

(4) Does not include subcooling portion of coil.

Performance Data — 60 HZ

10-25 Ton Full Load

Table 20-1 — 10 Ton — CGA 120

		Entering Condenser Air Temperature (Degree F)														
		75.0			85.0			95.0			105.0			115.0		
LWT (Deg F)	Percent Glycol	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER
20	28	6.0	8.1	8.8	5.6	8.6	7.8	5.2	8.9	7.0	4.8	9.1	6.3	N/A	N/A	N/A
25	24	6.7	8.6	9.4	6.3	9.0	8.4	5.9	9.4	7.5	5.4	9.8	6.7	5.0	10.1	5.9
30	19	7.5	9.0	10.0	7.0	9.4	9.0	6.6	9.8	8.0	6.1	10.3	7.1	5.6	10.7	6.3
35	14	8.3	9.3	10.7	7.8	9.9	9.5	7.3	10.3	8.5	6.8	10.7	7.6	6.3	11.2	6.7
40	0	9.2	9.6	11.6	8.7	10.2	10.2	8.2	10.8	9.1	7.6	11.3	8.1	7.0	11.8	7.1
42	0	9.5	9.7	11.8	9.0	10.3	10.5	8.5	10.9	9.3	7.9	11.5	8.2	7.3	12.0	7.2
44	0	9.8	9.8	12.0	9.3	10.5	10.7	8.8	11.1	9.5	8.1	11.7	8.4	7.5	12.3	7.4
45	0	10.0	9.9	12.2	9.5	10.5	10.8	8.9	11.2	9.5	8.3	11.8	8.4	7.7	12.4	7.4
46	0	10.2	9.9	12.3	9.6	10.6	10.9	9.0	11.3	9.6	8.4	11.9	8.5	7.8	12.5	7.5
48	0	10.5	10.0	12.5	9.9	10.8	11.1	9.3	11.4	9.8	8.7	12.1	8.6	8.0	12.7	7.6
50	0	10.8	10.1	12.8	10.2	10.9	11.3	9.6	11.6	10.0	9.0	12.3	8.8	8.3	12.9	7.7
55	0	11.6	10.4	13.3	11.0	11.2	11.8	10.4	12.0	10.4	9.7	12.8	9.1	9.0	13.5	8.0
60	0	12.4	10.7	13.9	11.8	11.6	12.2	11.1	12.4	10.7	10.4	13.3	9.4	9.7	14.1	8.2

Table 20-2 — 15 Ton — CGA 180

		Entering Condenser Air Temperature (Degree F)														
		75.0			85.0			95.0			105.0			115.0		
LWT (Deg F)	Percent Glycol	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER
20	28	9.3	12.6	8.8	8.5	12.9	7.9	7.7	13.1	7.1	7.0	13.2	6.3	N/A	N/A	N/A
25	24	10.5	13.4	9.4	9.7	13.8	8.4	8.8	14.1	7.5	8.0	14.3	6.7	7.1	14.4	6.0
30	19	11.8	14.2	10.0	10.9	14.7	8.9	10.0	15.1	7.9	9.1	15.5	7.1	8.2	15.6	6.3
35	14	13.1	15.0	10.5	12.2	15.6	9.4	11.2	16.1	8.3	10.3	16.6	7.4	9.3	16.9	6.6
40	0	14.8	15.8	11.2	13.7	16.6	10.0	12.7	17.2	8.8	11.7	17.8	7.9	10.6	18.2	7.0
42	0	15.3	16.1	11.4	14.3	16.9	10.1	13.2	17.6	9.0	12.1	18.2	8.0	11.0	18.7	7.1
44	0	15.8	16.4	11.6	14.8	17.2	10.3	13.7	18.0	9.1	12.6	18.6	8.1	11.5	19.1	7.2
45	0	16.1	16.5	11.7	15.0	17.4	10.4	13.9	18.2	9.2	12.8	18.8	8.2	11.7	19.4	7.3
46	0	16.4	16.7	11.8	15.3	17.6	10.4	14.2	18.3	9.3	13.1	19.0	8.2	11.9	19.6	7.3
48	0	16.9	17.0	12.0	15.8	17.9	10.6	14.7	18.7	9.4	13.5	19.4	8.4	12.4	20.1	7.4
50	0	17.5	17.3	12.1	16.3	18.2	10.7	15.2	19.1	9.5	14.0	19.9	8.5	12.8	20.3	7.5
55	0	18.8	18.0	12.6	17.7	19.0	11.1	16.5	20.0	9.9	15.2	20.9	8.8	14.0	21.6	7.8
60	0	20.3	18.7	13.0	19.0	19.9	11.5	17.8	21.0	10.2	16.5	21.9	9.0	15.2	22.8	8.0

Notes:
1. Based on the ethylene glycol concentration shown, a 10° delta T, a fouling factor of 0.00025 and sea level pressure.
2. Performance must be corrected for glycol concentrations other than those showing, delta T other than 10°, fouling factor and altitude.
3. Ethylene glycol is to be added and appropriate performance corrections are to be made for all leaving solution temperatures less than 40°F.

Table 20-3 — 20 Ton — CGAF-C20

		Entering Condenser Air Temperature (Degree F)														
		75.0			85.0			95.0			105.0			115.0		
LWT (Deg F)	Percent Glycol	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER
20	28	11.4	15.7	8.7	10.9	17.3	7.5	10.2	19.2	6.4	9.5	21.4	5.3	8.8	23.8	4.4
25	24	12.9	16.1	9.6	12.2	17.8	8.3	11.5	19.7	7.0	10.8	21.9	5.9	10.0	24.4	4.9
30	19	14.5	16.6	10.5	13.7	18.2	9.0	13.0	20.2	7.7	12.1	22.4	6.5	11.3	24.9	5.4
35	14	16.1	17.0	11.4	15.3	18.7	9.8	14.5	20.7	8.4	13.6	22.9	7.1	12.6	25.5	5.9
40	0	17.9	17.5	12.3	17.0	19.2	10.6	16.1	21.2	9.1	15.1	23.5	7.7	14.1	26.1	6.5
42	0	18.5	17.6	12.6	17.6	19.4	10.9	16.7	21.4	9.4	15.7	23.7	7.9	14.7	26.3	6.7
44	0	19.2	17.8	12.9	18.3	19.6	11.2	17.3	21.6	9.6	16.3	23.9	8.2	15.2	26.5	6.9
45	0	19.5	17.9	13.1	18.6	19.7	11.3	17.6	21.7	9.7	16.6	24.1	8.3	15.5	26.7	7.0
46	0	19.9	18.0	13.2	18.9	19.8	11.5	17.9	21.8	9.9	16.9	24.2	8.4	15.8	26.8	7.1
48	0	20.6	18.2	13.6	19.6	20.0	11.8	18.6	22.1	10.1	17.5	24.4	8.6	16.4	27.0	7.3
50	0	21.3	18.4	13.9	20.3	20.2	12.0	19.2	22.3	10.3	18.1	24.6	8.8	16.9	27.2	7.5
55	0	23.1	18.9	14.7	22.0	20.7	12.7	20.8	22.8	11.0	19.7	25.2	9.4	18.4	27.9	7.9
60	0	24.9	19.4	15.4	23.8	21.3	13.4	22.5	23.4	11.6	21.3	25.8	9.9	19.9	28.5	8.4

Table 20-4 — 25 Ton — CGAF-C25

		Entering Condenser Air Temperature (Degree F)														
		75.0			85.0			95.0			105.0			115.0		
LWT (Deg F)	Percent Glycol	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER	Capacity (Tons)	System KW	EER
20	28	15.2	21.3	8.6	14.4	23.3	7.4	13.5	25.5	6.4	12.6	28.1	5.4	11.7	31.1	4.5
25	24	17.2	21.8	9.4	16.2	23.8	8.2	15.3	26.1	7.0	14.3	28.8	6.0	13.3	31.8	5.0
30	19	19.2	22.3	10.3	18.2	24.4	9.0	17.2	26.8	7.7	16.1	29.5	6.6	15.0	32.5	5.5
35	14	21.4	22.9	11.2	20.3	25.0	9.8	19.2	27.4	8.4	18.0	30.2	7.2	16.9	33.3	6.1
40	0	23.7	23.5	12.1	22.5	25.6	10.6	21.3	28.1	9.1	20.1	30.9	7.8	18.8	34.1	6.6
42	0	24.6	23.7	12.4	23.4	25.9	10.8	22.1	28.4	9.4	20.9	31.2	8.0	19.6	34.3	6.8
44	0	25.5	23.9	12.8	24.2	26.1	11.1	23.0	28.6	9.6	21.7	31.5	8.3	20.3	34.6	7.0
45	0	25.9	24.0	12.9	24.7	26.2	11.3	23.4	28.8	9.8	22.1	31.6	8.4	20.7	34.8	7.1
46	0	26.4	24.1	13.1	25.1	26.4	11.4	23.8	28.9	9.9	22.5	31.7	8.5	21.1	34.9	7.2
48	0	27.3	24.4	13.4	26.0	26.6	11.7	24.7	29.2	10.2	23.3	32.0	8.7	21.9	35.2	7.4
50	0	28.2	24.6	13.8	26.9	26.9	12.0	25.5	29.4	10.4	24.1	32.3	9.0	22.7	35.5	7.6
55	0	30.7	25.2	14.6	29.2	27.5	12.7	27.8	30.1	11.0	26.2	33.1	9.5	24.7	36.3	8.1
60	0	33.2	25.9	15.4	31.6	28.2	13.4	30.0	30.9	11.7	28.4	33.9	10.1	26.8	37.1	8.6

Notes:
1. Data based on 0.00025 fouling factor at sea level.
2. Interpolation between points is permissible.
3. Extrapolation beyond points is not permissible.
4. EER - Energy Efficiency Ratio (Btu/watt-hour). Power inputs include compressors, condenser fans and control power
5. Ratings based on evaporator drop of 10°F
6. Ratings based on ARI Standard 590-92.
7. Minimum recommended ethylene glycol percentage used for leaving water temperatures below 40°F.

Performance Data - 60 HZ

10-60 Tons Part Load

Table 23-1 — Part Load Data, ARI Points (10-60 Tons)

Tons	Model Number		Entering Condenser Air Temperature (Degrees F) 95 100% Load	87 60% Load	85 75% Load	79 60% Load	75 50% Load	71 40% Load	67 30% Load	65 25% Load
		EER	9.4	—	—	—	11.5	—	—	—
10	CGA 120	Capacity (Tons)	8.7	—	—	—	4.8	—	—	—
		KW Input	11.1	—	—	—	5.0	—	—	—
		EER	9.1	—	—	—	10.3	—	—	—
15	CGA 180	Capacity (Tons)	13.7	—	—	—	7.0	—	—	—
		KW Input	18.0	—	—	—	8.2	—	—	—
		EER	9.6	—	—	—	13.8	—	—	—
20	CGAF-C20	Capacity (Tons)	17.3	—	—	—	10.2	—	—	—
		KW Input	21.6	—	—	—	8.9	—	—	—
		EER	9.6	—	—	12.9	—	13.5	—	—
25	CGAF-C25	Capacity (Tons)	23.0	—	—	15.8	—	10.9	—	—
		KW Input	28.6	—	—	14.7	—	9.7	—	—
		EER	9.6	—	—	—	13.0	—	—	—
30	CGAF-C30	Capacity (Tons)	27.4	—	—	—	16.2	—	—	—
		KW Input	34.1	—	—	—	14.9	—	—	—
		EER	9.6	—	11.6	—	14.0	—	—	15.4
40	CGAF-C40	Capacity (Tons)	33.8	—	27.4	—	20.3	—	—	10.3
		KW Input	42.2	—	28.4	—	17.3	—	—	8.0
		EER	9.6	11.1	—	12.9	—	—	14.9	—
50	CGAF-C50	Capacity (Tons)	42.3	36.1	—	29.3	—	—	14.9	—
		KW Input	52.7	39.0	—	27.3	—	—	12.0	—
		EER	9.6	—	11.7	—	14.6	—	—	16.1
60	CGAF-C60	Capacity (Tons)	55.9	—	45.7	—	34.3	—	—	17.3
		KW Input	69.7	—	46.9	—	28.2	—	—	12.9

Notes:
1. Data is rated in accordance with ARI Standard 590-92, Section 7.3.
   — 44°F leaving chilled water temperature.
   — (55°F + 0.4°F x % Load) = entering ambient temperature.
   — Constant evaporator waterflow as determined at full load operation at 95°F and 10°F evaporator temperature drop.
   — % Load by compressor displacement as defined by ARI Standard 590-92.
2. EER = Energy Efficiency Ratio, (Btu/watt-hour). Power inputs include compressors, condenser fans and control power.

Table 23-2 — Integrated Part Load Values

Tons	Model Number	IPLV
10	CGA 120	10.8
15	CGA 180	9.9
20	CGAF-C20	12.2
25	CGAF-C25	12.0
30	CGAF-C30	11.7
40	CGAF-C40	12.5
50	CGAF-C50	12.1
60	CGAF-C60	12.8

Notes:
1. Integrated Part Load Values are EERs in (BTU/watt-hour).

Electrical Data - 60 HZ

10-60 Tons

Table 26-1 — Electrical Data

Tons	Model Number	Unit Wiring Nameplate Voltage	Voltage Range	MCA	Max Fuse Size	Rec. Dual Element	Motor Data Compressor (Ea) Qty.	RLA	LRA	Fans (Ea) Qty	KW	FLA
10	CGA120B1	208-230/60/1	187-254	71.0	90		2	28.9	150	1	.95	6.0
	CGA120B3	208-230/60/3	187-254	48.3	60		2	18.8	118	1	.95	6.0
	CGA120B4	460/60/3	414-506	25.2	35		2	10.0	71	1	.95	2.7
	CGA120BW	575/60/3	518-632	17.3	20		2	6.8	43	1	.95	2.0
15	CGA180B3	208-230/60/3	187-254	72.6	90		2	29.5	179	2	1.03	3.1
	CGA180B4	460/60/3	414-506	33.6	40		2	13.5	90	2	1.03	1.6
	CGA180BW	575/60/3	518-632	26.7	35		2	10.8	72	2	1.03	1.2
20	CGAF-C20	200/60/3	180-220	98	125	110	2	39.4	269	2	0.9	4.1
		230/60/3	208-254	98	125	110	2	39.4	251	2	0.9	4.1
		460/60/3	416-508	44	60	50	2	17.2	117	2	0.9	1.8
		575/60/3	520-635	33	45	40	2	13.2	94	2	0.9	1.4
25	CGAF-C25	200/60/3	180-220	124	175	150	2	39.3,56.9	269,409	3	0.9	4.1
		230/60/3	208-254	124	175	150	2	39.3,56.9	251,376	3	0.9	4.1
		460/60/3	416-508	56	80	70	2	17.1,25.4	117,178	3	0.9	1.8
		575/60/3	520-635	44	60	50	2	13.8,20.2	94,143	3	0.9	1.4
30	CGAF-C30	200/60/3	180-220	146	200	175	2	56.9	409	4	0.9	4.1
		230/60/3	208-254	146	200	175	2	56.9	376	4	0.9	4.1
		460/60/3	416-508	65	80	80	2	25.1	178	4	0.9	1.8
		575/60/3	520-635	51	70	60	2	19.9	143	4	0.9	1.4
40	CGAF-C40	200/60/3	180-220	187	225	200	4	39.4	269	4	0.9	4.1
		230/60/3	208-254	186	225	200	4	39.4	251	4	0.9	4.1
		460/60/3	416-508	82	90	90	4	17.2	117	4	0.9	1.8
		575/60/3	520-635	62	70	70	4	13.2	94	4	0.9	1.4
50	CGAF-C50	200/60/3	180-220	224	250	250	4	35.5,55.5	269,409	6	0.9	4.1
		230/60/3	208-254	223	250	250	4	35.5,55.5	251,376	6	0.9	4.1
		460/60/3	416-508	98	110	110	4	15.5,24.2	117,178	6	0.9	1.8
		575/60/3	520-635	77	90	90	4	12.4,19.4	94,143	6	0.9	1.4
60	CGAF-C60	200/60/3	180-220	270	300	300	4	56.9	409	6	0.9	4.1
		230/60/3	208-254	269	300	300	4	56.9	376	6	0.9	4.1
		460/60/3	416-508	120	125	125	4	25.4	178	6	0.9	1.8
		575/60/3	520-635	95	110	100	4	20.2	143	6	0.9	1.4

Notes:
1. MCA: Minimum Circuit Ampacity is 125% of the largest compressor RLA plus 100% of the other compressor(s) RLA plus the sum of the condenser fan FLA plus any other load rated at 1 AMP or more
2. Maximum Fuse Size: 225% of the largest compressor RLA plus 100% of the other compressor(s) RLA plus the sum of the condenser fan FLA plus any other load rated at 1 AMP or more
3. Recommended Dual Element Fuse Size: 150% of the largest compressor RLA plus 100% of the other compressor(s) RLA plus the sum of the condenser fan FLA plus any other load rated at 1 AMP or more.
4. RLA: Rated in accordance with UL standard 1995.
5. Local codes may take precedence.
6. All units are across the line starting. Compressors will never start simultaneously.
7. One 115/60/1, 15 AMP jobsite provided power connection is required to operate the evaporator heat tape.

Load Definitions

LOAD1 = Current of the largest motor — compressor or fan motor
LOAD2 = Sum of the currents of all remaining motors
LOAD3 = Current of electric heaters
LOAD4 = Any other load rated at 1 amp or more

MCA = (1.25 x LOAD1) + LOAD2 + LOAD4

MOP = (2.25 x LOAD1) + LOAD2 + LOAD4

Select a fuse rating equal to the MOP value. If the MOP value does not equal a standard fuse size as listed in NEC 240-6, select the next **lower** standard fuse rating.

NOTE: If selected MOP is less than the MCA, then reselect the lowest standard maximum fuse size which is equal to or larger than the MCA, provided the reselected fuse size does not exceed 800 amps.

RDE =(1.5 x LOAD1) + LOAD2 + LOAD4

Select a fuse rating equal to the RDE value. If the RDE value does not equal a standard fuse size as listed in NEC 240-6, select the next **higher** standard fuse rating.

NOTE: If the selected RDE is greater than the selected MOP value, then reselect the RDE value to equal the MOP value.

DSS =1.5 x (LOAD1 + LOAD2 + LOAD3 + LOAD4)

Select a disconnect switch size equal to or larger than the DSS value calculated.

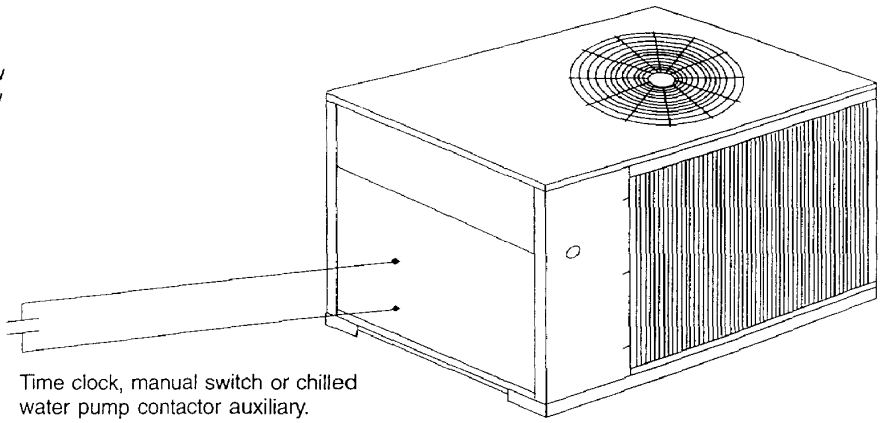
Stand-Alone Unit

Interface to stand-alone units is very simple; only a remote auto-stop or chilled water flow interlock signal for scheduling is required for unit operation. Signals from the chilled water pump contactor auxiliary or a flow switch are wired to the chilled waterflow interlock. Signals from a time clock or some other remote device are wired to the external auto-stop input. Unit controls do not provide an output to turn pumps on and off.

Required Features

1
External Auto/Stop (Standard)
- or -
2
Chilled Waterflow Interlock (Standard)

Figure 28-1 — Stand-Alone Unit



Time clock, manual switch or chilled water pump contactor auxiliary.

Trane Integrated Comfort™ System Interface

A single twisted pair of wires tied directly between the CGA unit and a Tracer® system provides control, monitoring and diagnostic capabilities. Control functions include auto/stop, compressor operation lockout for kw demand limiting. In addition, the Tracer system can provide sequencing control for two or three CGA units on the same chilled water loop. Pump sequencing control can be provided from the Tracer system also. Sequencing of two CGA's can be accomplished with the DDC Chiller Sequencer.

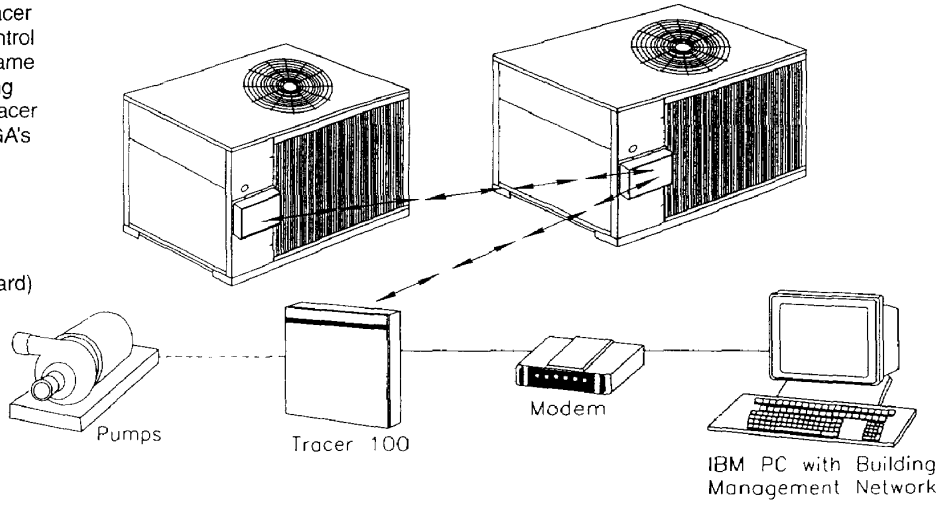
Required Features

1
Unit Temperature Controller (Standard)
2
ICS Interface Panel

External Trane Devices Required

1
Tracer 100 System
- or -
Tracer L System

Figure 28-2 — Tracer® ICS System Interface Schematic



ELECTRICAL CONTROL SYSTEM

The controls used on CGA 10 and 15-ton units are classified either as "safety" controls or "operational" controls. Brief descriptions of the specific safety and operating controls used in the CGA control scheme are provided in the following paragraphs.

Refer to the following control descriptions for control settings.

UNIT SAFETY CONTROLS

Low Pressure Cutout (LPC01, LPC02) Mounted below the unit control box are two low pressure cutouts that open and stop compressor operation if the operating pressure drops below 38.5 ± 1 psig. The cutout automatically resets when the pressure reaches 44.5 ± 2 psig. The LPCO is a SPDT device. If it opens at low ambient start-up, it will energize ODF relay, stopping the outdoor fan(s) while the compressor remains energized through the LAST (Low Ambient Start Timer).

High Pressure Cutout (HPC01, HPC02) —These units have high pressure cutouts that open and stop compressor operation if the discharge pressure reaches 400 ± 10 psig. The cutout automatically resets when pressure drops to 250 ± 15 psig.

Reset Relays (RRS, RR2) — If the unit is shut down by the low pressure cutout (or high pressure cutout), the reset relay locks out the compressor contactor (CCS, CC2). This prevents the system from recycling until the condition that caused the low (or high) pressure cutout to trip is determined and corrected.

CAUTION: To prevent unit damage, do not reset the control circuit until the cause of the safety lockout is identified and corrected.

To reset RR1 and RR2, open and reclose the unit disconnect switch.

Low Temperature Cutout (LTC) — The LTC is designed to disable the unit if the leaving water temperature falls too low. The LTC's remote sensing bulb is mounted at the outlet end of the evaporator, where it monitors leaving water temperature.

During normal unit operation, if the low temperature cutout (LTC) senses a temperature falling to 36°F ± 3.0°F, the LTC will open to interrupt compressor operation. (Manual reset is required.)

Motor Overloads —These units have internal compressor and condenser fan motor overloads. These overloads protect the motors from overcurrent and overheating conditions and automatically reset as soon as they cool sufficiently.

UNIT OPERATIONAL CONTROLS

Water Temperature Thermostat (WTT) — System operation for 10 and 15-ton CGA units is governed by a two-stage water temperature thermostat (WTT). The remote sensing bulb of this device is factory-installed in a bulb well located on the evaporator water inlet; here, it monitors the temperature of the water returning to the evaporator.

Low Ambient Start Timer (LAST) — When one of the two timers energizes, the low pressure control is bypassed for four minutes, this allows time for suction pressure to build sufficiently for the low pressure cutout contacts to close.

Hot Gas Bypass Timer, Solenoid (HGBT, HGBS) —The hot gas bypass option is factory-installed only, and is used in a chilled water system to keep the first stage compressor on-line during short no-load or light-load conditions. When Water Temperature Thermostat (WTT) first stage opens, 24-volt power is supplied to the Compressor Contactor (CC1) through Hot Gas Bypass Timer (HGBT) pins one and four. Power is also applied from WTT-B to HGBT coil (fixed 30-minute time delay pick-up) and to the Hot Gas Bypass Solenoid (HGBS) through HGBT pins eight and five. If first stage cooling remains satisfied for 30 minutes, HGBT will energize and shut down the compressor. If there is a call for cooling during HGBP mode, the unit will return to cooling mode.

The adjustable hot gas bypass valve is factory set at 70 psig.

Note: Hot gas bypass is available only on the lead compressor circuit.

Anti-Short Cycle Timers (ASCT1, ASCT2) — An anti-short cycle timer is provided in each compressor control circuit to protect the compressors from starting too frequently. This can occur as a result of just over 0%, or just over 50% of the unit capacity, or because of sudden power outages of short duration. Whenever the contacts of the water temperature thermostat (WTT) open — or when there is a momentary power outage — the anti-short cycle timer will lock out compressor operation for three minutes.

Delay Between Compressors (DBC) —The delay between compressors prevents both compressors from starting at the same time by delaying compressor number two for 30 seconds.

Definition of Acronyms

ASCT	—	Anti-Short Cycle Timer
CC	—	Compressor Contactor
CWFIR	—	Chilled Water Flow Interlock Relay
CWPS	—	Chilled Water Pump Starter
DBC	—	Time Delay Between Compressors
HGBT	—	Hot Gas Bypass Timer
HPCO	—	High Pressure Cutout
LAST	—	Low Ambient Start Timer
LPCO	—	Low Pressure Cutout
LTC	—	Low Temperature Cutout
ODF	—	Outdoor Fan
RR	—	Reset Relay
SPDT	—	Single Pole, Double Throw
WTT	—	Water Temperature Thermostat

SEQUENCE OF UNIT OPERATION

Refer to the unit wiring schematic pasted to the inside of the control panel cover when reviewing the control sequence described below.

Refer to the legend on the previous page for an explanation of the acronyms used in this sequence.

10-Ton Operation

With fused disconnect switch closed, power is supplied to the crankcase heaters and the 24-volt control circuit.

Starting the chilled water pump closes the CWPS auxiliary contacts and completes the flow switch.

When the water temperature rises above the WTT's setpoint, its first stage switch closes, allowing power to pass through CWPS auxiliary contacts, the flow switch, the LTC, the ASCT1, the RR1 contacts, the LPC01, and the HPC01 to energize the CC1 coil. This starts compressor number one and the outdoor fan.

If compressor number one can't satisfy the cooling demand, WTT's 2nd stage switch closes, allowing power to pass through the CC1 auxiliary contacts, the DBC, the ASCT2, the RR2 contacts, the LPC02, and the HPC02 to energize the CC2 coil which starts compressor number two.

15-Ton Operation

With fused disconnect switch closed, power is supplied to the crankcase heaters, and the 24-volt control circuit.

Starting the chilled water pump closes the CWPS auxiliary contacts and completes the flow switch, allowing power to pass through the LTC to energize the CWFIR.

When the water temperature rises above the WTT's setpoint, its first stage switch closes, allowing power to pass through the CWFIR contacts, the ASCT1, the RR1 contacts, the LPC01, and the HPC01 to energize the CC1 coil. This starts compressor number one and outdoor fan number one.

If compressor number one can't satisfy the cooling demand, WTT's second stage switch closes, allowing power to pass through the CWFIR contacts, the DBC, the ASCT2, the RR2 contacts, the LPC02, and the HPC02 to energize the CC2 coil. This starts compressor number two and outdoor fan number two.

LOW AMBIENT OPERATION

Field Installed Head Pressure Control Accessory

Standard units will operate in outdoor ambient temperatures down to the values shown in the "General Data" section of this catalog. This accessory will enable units to operate down to much lower temperature extremes (see "General Data" section of this catalog).

Head pressure control for CGA units is regulated by means of a field-installed head pressure accessory which varies condenser fan speed in relation to discharge pressure.

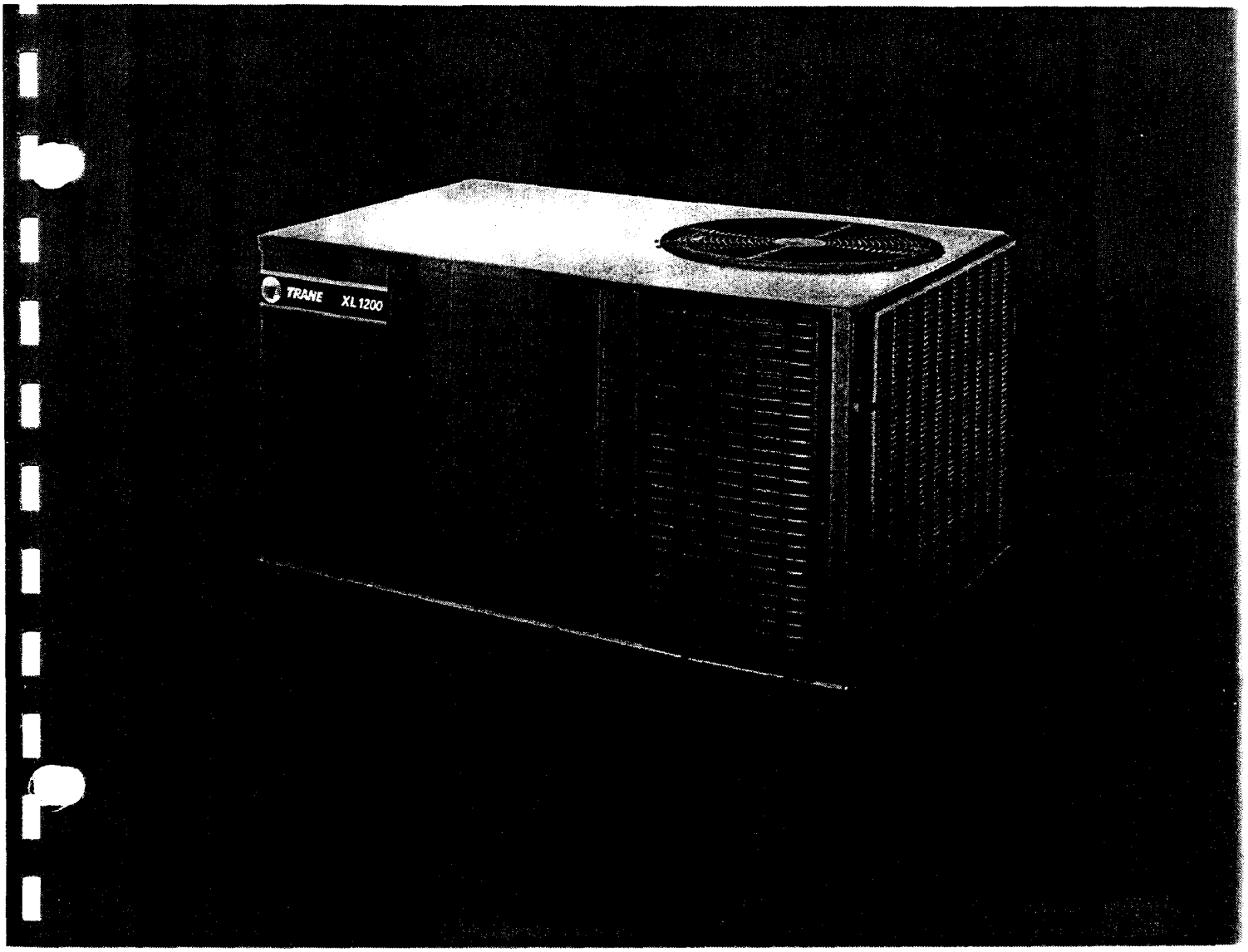
When discharge pressure is 270 psig or higher, the condenser fan runs at full speed. At pressures between 270 psig and 180 psig, the fan speed is adjusted (increased or decreased) in direct relation to the pressure, with minimum fan speed (10 percent of rated motor rpm) occurring when the pressure reaches 180 psig. At pressures below 180 psig, the fan will not run. When discharge pressure rises to 180 psig, the fan will start and run at the reduced speed. Fan speed will continue to increase, as the pressure increases, until full speed is reached at 270 psig.

TRANE™

Package Heat Pump Units

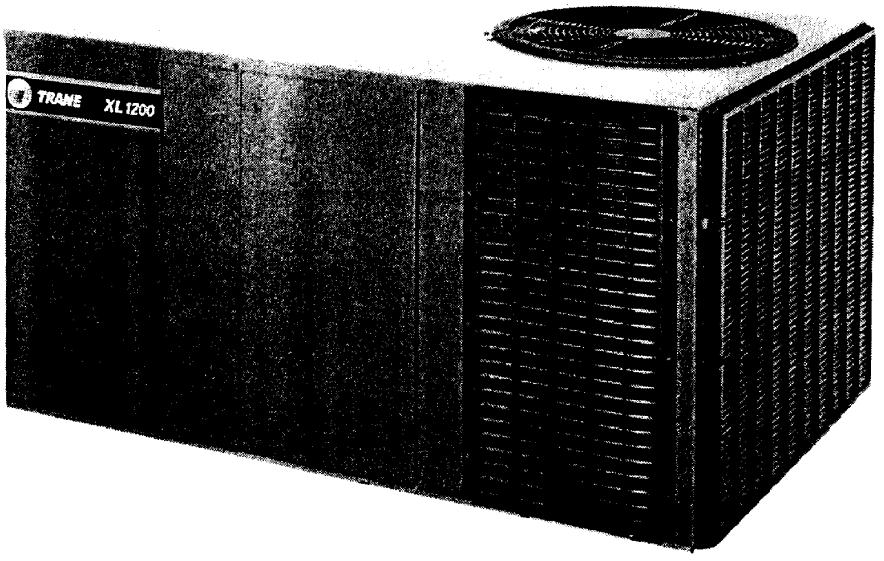
Convertible Models

WCY024-060F
2 — 5 Ton



Features and Benefits

It's Hard To Stop A Trane



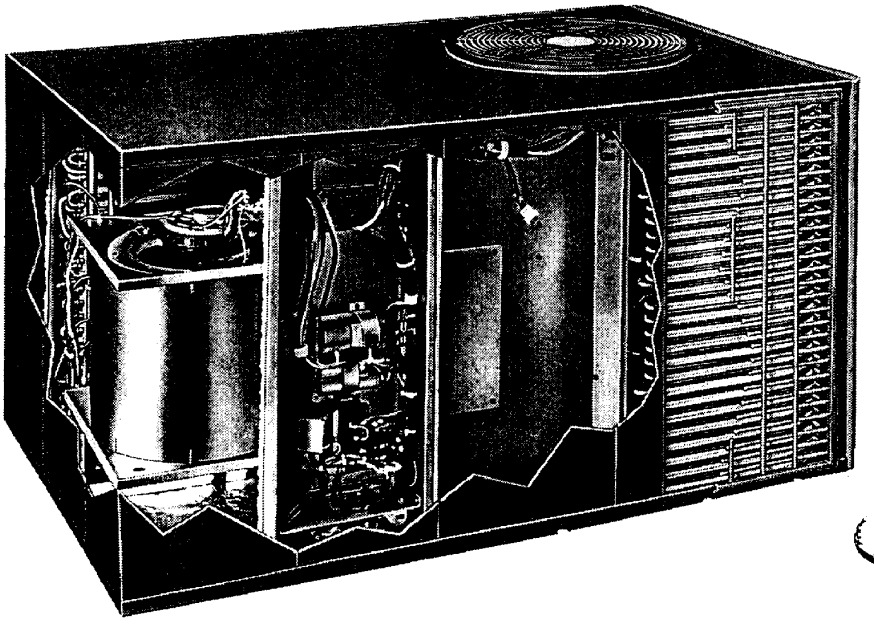
T-TOP™

COIL-SAV'R™ GRILLS

Ceramic Coated Screws

Powder Paint

WATER-SHED Base



High Efficiency

Climatuff™ Compressor

DuraTuff™ Plate Fin Coil

Demand Defrost Control

Easy Access

Features and Benefits

- **Coil Guards**

The **COIL-SAV'R™** end grille is a new Lexan® louvertype. The grille will protect the coil from hail, kids with sticks, and normal shipping, installation and handling damage. All side grilles are vinyl coated wire (end grilles on 048,060F).

- **Powder Paint**

Beautiful high gloss silver gray finish blends with any architectural style. New power paint covers surfaces uniformly increasing protection from rust and corrosion.

- **Corrosion Resistant Screws**

Holds it all together beautifully. Resists rust and corrosion.

- **Climatuff™ Compressor**

Protection against chemical, electrical, and mechanical stresses are built in for efficiency and a longer life. The compressor is backed by a 10-year limited warranty. (single phase residential use only)

- **Uni-Curb (One Size Fits All)**

A single curb fits the entire IMPACK line from 1.5 tons through 5 tons thereby providing great installation flexibility on shopping malls, factories, schools, and other commercial buildings where a mix-match of tonnages and utilities is desired.

- **WATER-SHED Base**

Superior water integrity is accomplished with the **WATER-SHED** base pan having elevated downflow openings and a perimeter channel that prevents water from draining into the ductwork.

- **Demand Defrost Control**

The electronic demand defrost control measures outdoor ambient and outdoor coil conditions and eliminates unnecessary defrost cycles for energy savings and longer compressor life.

- **Commonality**

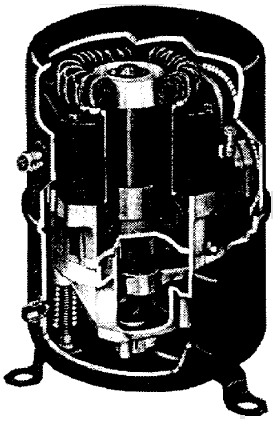
The common cabinet among the TCC's, WCC's, and YCC's minimizes both the training of sales and service personnel and replacement parts inventory.

- **Easy Access**

All electrical components can be diagnosed and replaced with the removal of one panel that is attached with two screws.

- **High Efficiency**

IMPACK performance is among the highest in the industry.



- **Duratuff™ Plate Fin Coil**

Refrigeration coils are built with internally enhanced copper tubing for high efficiency with less coil area.

- **T-TOP™**

Exclusive one piece, solid unit top for improved water integrity and easy component access.

- **Shipping**

Unit dimensions were carefully selected to provide an attractive aspect ratio and for shipping and handling considerations.

- **Good Neighbor**

Most units can be installed flush with the residence or building thereby minimizing the ground space required. Blankets of insulation reduce blower noise and energy losses to the outside environments.

- **Rooftop Mounting**

The cabinets are physically smaller than most competitive models. This means less intrusive installations on residential rooftops where aesthetics are critical.

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DATA SUBJECT TO CHANGE WITHOUT NOTICE.

Features and Benefits

• Convertibility

IMPACK units are easily converted from horizontal to down flow with the removal of one screw from each panel. Accordingly, the need to stock both dedicated horizontal and dedicated down flow models has been eliminated.

• Installation

The ease of installation and application flexibility exhibited through the design reduce both field time and material.

• Structure

The units are lighter weight through the use of high technology components thereby reducing mounting structure requirements and difficulty when manhandling.

• Handling

The three-way wooden skid allows for easy loading between the wheel wells on pickup trucks for transporting to job sites.

• Application

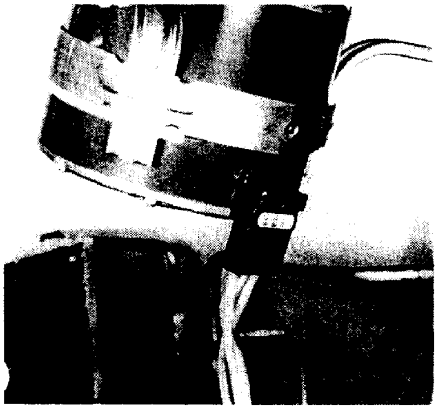
he low profile horizontal duct take-offs eliminate the need for expensive transition ducts in crawl space applications.

• Duct Flanges

Only IMPACK has downflow duct flanges for duct attachments that preserve the built-in water integrity.

• Service

All wiring is both numbered and color coded thereby reducing training and servicing costs related to circuit tracing and components replacements.



• Easy Fan Maintenance

A plug on the outdoor fan motor allows the top cover to be removed completely without the hassle of cumbersome wires. The unique service orifice ring allows the indoor fan motor/blower to be removed as a unit.

• Corrosion

The drain pan is engineered material and eliminates the need for coatings and sealers to prevent sweating and corrosion. The heavy gauge, zinc-coated steel cabinet has a weather resistant enamel finish that stays attractive and protects your investment for years.

• Low Ambient Control

Standard cooling operation to 55° as shipped, zero degree ambient cooling is accomplished with two kits. One for low cost installations when full tonnage is not needed. The other kit maintains head pressure and full capacity at zero degrees.

• Quality and Reliability Testing

We perform a 100% coil leak test at the factory. The evaporator and condenser coils are leak tested at 200 psig and pressure tested to 450 psig respectively. In addition the IMPACK designs were rigorously rain tested at the factory to ensure water integrity. Shipping tests are performed to determine packaging requirements. Factory shake and drop tests are used as part of the package design process to help assure that the unit will arrive at the job site in top condition. Additionally, all components are inspected at the point of final assembly. Substandard parts and components are identified and rejected immediately. Every unit receives a 100% run test before leaving the production line to make sure it lives up to rigorous Trane requirements. We at Trane test our designs at our factory and not on our customers!

Impack Accessories

• Standard Thermostats

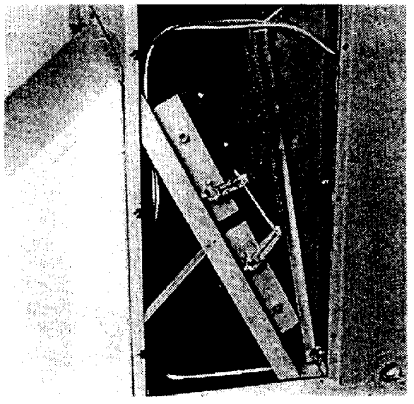
No special thermostats are needed with IMPACK units.

• Filter Frame Kit

The IMPACK filter frames accept standard filters and fit inside the unit. The frame kits function in either horizontal or downflow duct configurations.

• UNI-CURB

One universal curb fits all the IMPACK models. It ships knocked down. The curb design incorporates the popular locking tabs for quick and easy assembly. Full perimeter curbs are also available for all models.



• Economizer

The economizer fits inside the unit with only the rain hood and barometric relief on the outside. Cabling is shipped with the economizer. This cabling is easily routed to the control box where it terminates in low voltage pigtails. The economizer features a fully modulating low voltage motor eliminating the need for any high voltage wiring. The economizer must be used with the filter frame kit . . . no return air filter in the economizer kit. A dry bulb sensor is shipped with the economizer. The downflow economizer was not designed for use in horizontal applications. A horizontal only economizer is available. Heat pump applications require a relay kit.

Impack Accessories

• Enthalpy Control Kit

For those applications specifying an economizer with enthalpy control, this control can be used in place of the dry bulb sensor or, alternately, two enthalpy controls can be paired to provide differential enthalpy control.

• 25% Fresh Air Kit

The kit installs over the horizontal return air opening with six screws for downflow requirements. It can be used on horizontal air flow applications by cutting a hole in the return air duct or in the unit filter access panel.

• Rectangular to Round Duct Kits

The adapter kit can be used in either horizontal or downflow applications.

• Electric Heaters

One family of electric heaters serves the entire line of 2 to 5 ton TCY, WCY. This will provide the highest degree of flexibility while allowing for minimal inventory level.

• Fan Delay Relay Kit

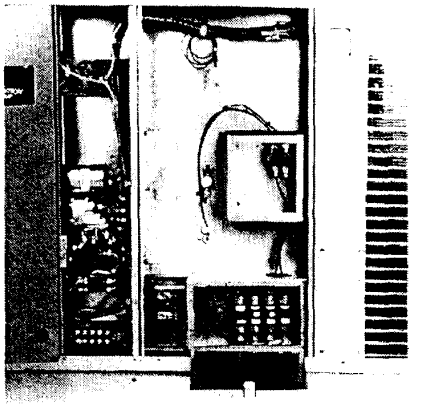
This solid state kit is a time delay that keeps the indoor blower on for about ninety seconds and increases the SEER. It wires into the low voltage unit pigtails.

• High Static Motor Kit

Contains a higher torque indoor fan motor.

• Lifting Lug Kit

Four reusable lugs in each kit allow units to be easily lifted to rooftop installations. These lugs snap (no screws required) into slots in the unit drip lip channel.



• Single Power Entry Kit

The kit minimizes installation costs by reducing the load center circuit requirement and reducing the number of circuit pulls needed.

Model Number Description

W C Y 0 2 4 F 1 0 0 A A

PRODUCT TYPE
YC = Packaged Gas/Electric
TC = Packaged Cooling
WC = Packaged Heat Pumps

AIRFLOW CONFIGURATION
C = Convertible
D = Downflow
H = Horizontal
M = Manufactured Housing
X = High Efficiency
Y = 12 SEER

NOMINAL NET COOLING CAPACITY (MBH)
024 = 2 Tons
030 = 2 1/2 tons
036 = 3 Tons
042 = 3 1/2 Tons
048 = 4 Tons
060 = 5 Tons

MAJOR DEVELOPMENT SEQUENCE
F = Impack

ELECTRICAL CHARACTERISTICS
1 = 208-230/60/1
3 = 208-230/60/3
4 = 460/60/3

AUXILIARY HEATING CAPACITY
L = Low Heat
M = Medium Heat
H = High Heat
0 = No Heat

FACTORY INSTALLED OPTIONS
EXAMPLES:
0 = No factory installed options
B = Oversize Motor*
N = Filter Frame*
T = Fan Delay Relay*
* Product Deviation Required

MINOR DESIGN SEQUENCE

SERVICE DESIGN

General Data

MODEL	WCY024F100A	WCY030F100A	WCY036F100A	WCY036F300A	WCY036F400A
RATED VOLTS/PH/HZ	208-230/1/60	208-230/1/60	208-230/1/60	208-230/3/60	460/3/60
A.R.I. RATINGS (COOLING)①					
BTUH	24000	29400	35600	35600	35600
Indoor Air Flow (CFM)	800	1000	1200	1200	1200
Power Input (KW)	2.35	2.83	3.42	3.42	3.42
EER/SEER (BTU/WATT-HR.)⑥	10.20 / 12.00	10.40 / 12.00	10.40 / 12.00	10.40 / 12.00	10.40 / 12.00
Noise Rating No.②	8.0	8.0	8.0	8.0	8.0
RATINGS (HEATING)①					
(High Temp.) BTUH & C.O.P.	24000 - 3.10	29200 - 3.26	35200 - 3.38	35200 - 3.38	35200 - 3.38
Power Input (KW)	2.27	2.63	3.05	3.05	3.05
(Low Temp.) BTUH & C.O.P.	12700 - 2.00	15000 - 2.00	17700 - 2.00	17700 - 2.00	17700 - 2.00
Power Input (KW)	1.86	2.20	2.59	2.59	2.59
HSPF (BTU/WATT-HR.)⑥	7.00	7.25	7.30	7.30	7.30
POWER CONNS.—V/PH/HZ	208-230/1/60	208-230/1/60	208-230/1/60	208-230/3/60	460/3/60
Min. Brch. Cir. Ampacity③	17.1	20.4	25.9	17.9	9.7
Br. Cir.—Max. (Amps)	25	30	40	25	15
Prot. Rtg.—Recmd. (Amps)	25	30	40	25	15
COMPRESSOR	CLIMATUFF™	CLIMATUFF™	CLIMATUFF™	CLIMATUFF™	CLIMATUFF™
No. Used—No. Speeds	1 - 1	1 - 1	1 - 1	1 - 1	1 - 1
Volts/PH/HZ	200-230/1/60	200-230/1/60	200-230/1/60	200-230/3/60	460/3/60
R.L. Amps—L.R. Amps	11.1 - 57	12.8 - 65	14.1 - 91	10.8 - 101	5.3 - 51
Brch. Cir. Selec. Cur. Amps	11.0	12.4	17.2	10.6	5.1
OUTDOOR COIL—TYPE	PLATE FIN	PLATE FIN	PLATE FIN	PLATE FIN	PLATE FIN
Rows / F.P.I.	2 / 15	2 / 15	2 / 22	2 / 22	2 / 22
Face Area (Sq. Ft.)	8.64	11.35	11.35	11.35	11.35
Tube Size (In.)	3/8 COPPER	3/8 COPPER	3/8 COPPER	3/8 COPPER	3/8 COPPER
Refrigerant Control	TXVNB	TXV-NB	TXV-NB	TXV-NB	TXV-NB
INDOOR COIL—TYPE	PLATE FIN	PLATE FIN	PLATE FIN	PLATE FIN	PLATE FIN
Rows / F.P.I.	3 / 15	3 / 15	4 / 15	4 / 15	4 / 15
Face Area (Sq. Ft.)	3.96	3.96	4.28	4.28	4.28
Tube Size (In.)	3/8 COPPER	3/8 COPPER	3/8 COPPER	3/8 COPPER	3/8 COPPER
Refrigerant Control	TXV-NB	TXV-NB	TXV-NB	TXV-NB	TXV-NB
Drain Conn. Size (in.)	3/4 FEMALE NPT	3/4 FEMALE NPT	3/4 FEMALE NPT	3/4 FEMALE NPT	3/4 FEMALE NPT
Duct Connections	SEE OUTLINE DRAWING	SEE OUTLINE DRAWING	SEE OUTLINE DRAWING	SEE OUTLINE DRAWING	SEE OUTLINE DRAWING
OUTDOOR FAN—TYPE	PROPELLER	PROPELLER	PROPELLER	PROPELLER	PROPELLER
No. Used / Dia. (in.)	1 / 18	1 / 18	1 / 18	1 / 18	1 / 18
Type Drive / No. Speeds	DIRECT / 1	DIRECT / 1	DIRECT / 1	DIRECT / 1	DIRECT / 1
CFM vs. 0.0 In. W.G.④	2300	2500	2500	2500	2500
No. Motors—HP	1 - 1/5	1 - 1/5	1 - 1/5	1 - 1/5	1 - 1/2
Motor Speed R.P.M.	1080	1080	1080	1080	1080
Volts/PH/HZ	230/1/60	230/1/60	230/1/60	230/1/60	460/1/60
F.L. Amps—L.R. Amps	1.6 - 3.3	1.6 - 3.3	1.6 - 3.3	1.6 - 3.3	1.7 - 3.8
INDOOR FAN—TYPE	CENTRIFUGAL	CENTRIFUGAL	CENTRIFUGAL	CENTRIFUGAL	CENTRIFUGAL
Dia. x Width (in.)	9 X 9	10 X 9	10 X 9	10 X 9	10 X 9
No. Used	1	1	1	1	1
Drive / Speeds (No.)	DIRECT / 2	DIRECT / 2	DIRECT / 2	DIRECT / 2	DIRECT / 2
CFM vs. In. W.G.⑤	SEE FAN PERFORMANCE TABLE	SEE FAN PERFORMANCE TABLE	SEE FAN PERFORMANCE TABLE	SEE FAN PERFORMANCE TABLE	SEE FAN PERFORMANCE TABLE
No. Motors—HP	1 - 1/4	1 - 1/3	1 - 1/3	1 - 1/3	1 - 1/3
Motor Speed R.P.M.	1080	1080	1080	1080	1080
Volts/PH/HZ	200-230/1/60	200-230/1/60	200-230/1/60	200-230/1/60	460/1/60
F.L. Amps—L.R. Amps	1.6/1.4 - 2.9	2.8/2.2 - 5.1	2.8/2.2 - 5.1	2.8/2.2 - 5.1	1.1 - 2.6
FILTER—FURNISHED?	NO	NO	NO	NO	NO
Type Recommended	THROWAWAY	THROWAWAY	THROWAWAY	THROWAWAY	THROWAWAY
Min Face Area - Lo (Sq. Ft.)⑦	2.67	3.33	4.0	4.0	4.0
REFRIGERANT					
Charge	7 LBS. 6 OZ.	8 LBS. 5 OZ.	8 LBS. 10 OZ.	8 LBS. 10 OZ.	8 LBS. 10 OZ.
DIMENSIONS	H X W X D	H X W X D	H X W X D	H X W X D	H X W X D
Crated (in.)	35-1/4 X 38 X 57	35-1/4 X 38 X 57	35-1/4 X 38 X 64-5/8	35-1/4 X 38 X 64-5/8	35-1/4 X 38 X 64-5/8
Uncrated	SEE OUTLINE DRAWING	SEE OUTLINE DRAWING	SEE OUTLINE DRAWING	SEE OUTLINE DRAWING	SEE OUTLINE DRAWING
WEIGHT					
Shipping (lbs.) / Net (lbs.)	387 / 331	398 / 342	468 / 398	468 / 398	468 / 398

① **Rated in accordance with A.R.I. Standard 210/240.**
② **Rated in accordance with A.R.I. Standard 270.**
③ Calculated in accordance with currently prevailing Nat'l Electric Code. Suitable for use with HACR circuit breakers or fuses.
④ Standard Air — Dry Coil — Outdoor.
⑤ Standard Air — Wet Coil — Indoor.
⑥ Rated in accordance with D.O.E. test procedure. HSPF is at the minimum design requirement for Region IV.
⑦ Filters must be installed in return air stream. Square footages listed are based on 300 f.p.m. face velocity. If permanent filters are used size per manufacturer's recommendation with a clean resistance of 0.05" W.C.

Performance Data Cooling

WCY024F—A AT 800 CFM

(CAPACITIES ARE NET IN BTUH/1000-INDOOR FAN HEAT DEDUCTED)

O.D. D.B.	I.D. W.B.	TOTAL CAP.	SENS. CAP. AT ENTERING D.B. TEMP. 72	74	76	78	80	COMPR. KW	APP.DEW PT.
85	59	23.1	17.8	19.2	20.7	22.1	23.2*	1.62	45.7
	63	24.8	15.0	16.4	17.9	19.3	20.7	1.65	49.7
	67	26.6	12.0	13.4	14.8	16.2	17.6	1.68	53.8
	71	28.4	8.8	10.2	11.6	13.0	14.4	1.72	58.1
90	59	21.9	17.3	18.7	20.1	21.5	22.3*	1.67	46.6
	63	23.5	14.5	15.9	17.3	18.7	20.2	1.70	50.5
	67	25.3	11.5	12.9	14.3	15.7	17.1	1.74	54.7
	71	27.1	8.3	9.7	11.1	12.5	14.0	1.78	59.0
95	59	20.6	16.8	18.2	19.6	20.8*	21.3*	1.72	47.5
	63	22.3	14.0	15.4	16.8	18.2	19.6	1.76	51.4
	67	24.0	11.0	12.4	13.8	15.2	16.6	1.80	55.0
	71	25.7	7.8	9.2	10.7	12.1	13.5	1.84	59.8
100	59	19.4	16.2	17.6	19.0	19.8*	20.3*	1.77	48.3
	63	21.0	13.5	14.9	16.3	17.7	19.1	1.81	52.2
	67	22.7	10.5	11.9	13.3	14.7	16.1	1.86	56.3
	71	24.4	7.4	8.8	10.2	11.6	13.0	1.90	60.6
105	59	18.2	15.7	17.1	18.3*	18.8*	19.3*	1.82	49.2
	63	19.7	13.0	14.4	15.8	17.2	18.6	1.86	53.0
	67	21.4	10.0	11.4	12.8	14.2	15.6	1.92	57.2
	71	23.1	6.9	8.3	9.7	11.1	12.5	1.97	61.4
115	59	15.7	14.6	15.9*	16.4*	16.9*	17.4*	1.92	51.0
	63	17.2	11.9	13.3	14.7	16.1	17.4*	1.97	54.7
	67	18.8	9.0	10.4	11.8	13.2	14.6	2.03	58.8
	71	20.4	5.9	7.3	8.7	10.2	11.6	2.09	63.0

CORRECTION FACTORS - OTHER AIRFLOWS
(multiply or add as indicated)

AIRFLOW	700	900
TOTAL CAP.	X0.99	X1.01
SENS. CAP.	X0.95	X1.05
COMPR. KW	X1.00	X1.00
A.D.P.	-1.6	+1.2

VALUES AT ARI RATING CONDITIONS

TOTAL NET CAPACITY = 24000 BTUH
AIRFLOW = 800 CFM
APP. DEW PT. = 55.0 DEG. F
COMPRESSOR POWER = 1800 WATTS
I.D. FAN POWER = 300 WATTS
O.D. FAN POWER = 250 WATTS
S.E.E.R. = 12.00 BTUH/WATT
E.E.R. = 10.20 BTUH/WATT

* DRY COIL CONDITION (TOTAL CAPACITY = SENSIBLE CAPACITY)
TOTAL CAPACITY,COMP. KW AND APP. DEW PT. ARE VALID ONLY FOR WET COILS.
ALL TEMPERATURES IN DEGREES F.

WCY030F—A AT 1000 CFM

(CAPACITIES ARE NET IN BTUH/1000-INDOOR FAN HEAT DEDUCTED)

O.D. D.B.	I.D. W.B.	TOTAL CAP.	SENS. CAP. AT ENTERING D.B. TEMP. 72	74	76	78	80	COMPR. KW	APP.DEW PT.
85	59	27.6	21.7	23.5	25.3	27.0	28.1*	1.96	46.2
	63	29.7	18.3	20.0	21.8	23.5	25.3	1.99	50.1
	67	32.0	14.4	16.2	18.0	19.7	21.5	2.02	54.2
	71	34.2	10.5	12.3	14.0	15.8	17.6	2.05	58.5
90	59	26.4	21.2	23.0	24.7	26.5*	27.1*	2.04	46.8
	63	28.5	17.8	19.5	21.3	23.0	24.8	2.08	50.7
	67	30.7	13.9	15.7	17.5	19.2	21.0	2.12	54.9
	71	32.9	10.0	11.8	13.6	15.3	17.1	2.16	59.1
95	59	25.2	20.7	22.5	24.2	25.5*	26.2*	2.13	47.5
	63	27.3	17.2	19.0	20.8	22.5	24.3	2.17	51.4
	67	29.4	13.5	15.2	17.0	18.7	20.5	2.22	55.5
	71	31.6	9.6	11.3	13.1	14.9	16.6	2.27	59.8
100	59	24.1	20.2	21.9	23.7	24.6*	25.2*	2.22	48.1
	63	26.0	16.7	18.5	20.3	22.0	23.8	2.27	52.0
	67	28.1	13.0	14.7	16.5	18.3	20.0	2.32	56.1
	71	30.2	9.1	10.9	12.6	14.4	16.2	2.37	60.4
105	59	22.9	19.7	21.4	23.0*	23.6*	24.3*	2.30	48.8
	63	24.8	16.2	18.0	19.8	21.5	23.3	2.36	52.7
	67	26.8	12.5	14.2	16.0	17.8	19.5	2.42	56.8
	71	28.9	8.6	10.4	12.2	13.9	15.7	2.48	61.0
115	59	20.5	18.6	20.5*	21.1*	21.8*	22.4*	2.47	50.1
	63	22.3	15.2	17.0	18.8	20.5	22.4*	2.54	54.0
	67	24.3	11.5	13.3	15.0	16.8	18.6	2.62	58.1
	71	26.2	7.7	9.4	11.2	13.0	14.7	2.70	62.3

CORRECTION FACTORS - OTHER AIRFLOWS
(multiply or add as indicated)

AIRFLOW	875	1125
TOTAL CAP.	X0.99	X1.01
SENS. CAP.	X0.94	X1.05
COMPR. KW	X1.00	X1.00
A.D.P.	-1.5	+1.2

VALUES AT ARI RATING CONDITIONS

TOTAL NET CAPACITY = 29400 BTUH
AIRFLOW = 1000 CFM
APP. DEW PT. = 55.5 DEG. F
COMPRESSOR POWER = 2220 WATTS
I.D. FAN POWER = 380 WATTS
O.D. FAN POWER = 230 WATTS
S.E.E.R. = 12.00 BTUH/WATT
E.E.R. = 10.40 BTUH/WATT

* DRY COIL CONDITION (TOTAL CAPACITY = SENSIBLE CAPACITY)
TOTAL CAPACITY,COMP. KW AND APP. DEW PT. ARE VALID ONLY FOR WET COILS.
ALL TEMPERATURES IN DEGREES F.

WCY036F—A AT 1200 CFM

(CAPACITIES ARE NET IN BTUH/1000-INDOOR FAN HEAT DEDUCTED)

O.D. D.B.	I.D. W.B.	TOTAL CAP.	SENS. CAP. AT ENTERING D.B. TEMP. 72	74	76	78	80	COMPR. KW	APP.DEW PT.
85	59	34.2	26.5	28.7	30.8	32.9	34.5*	2.47	45.5
	63	36.6	22.3	24.4	26.5	28.6	30.8	2.51	49.5
	67	39.1	17.6	19.7	21.8	24.0	26.1	2.55	53.8
	71	41.6	12.8	14.9	17.0	19.1	21.3	2.59	58.1
90	59	32.6	25.8	28.0	30.1	32.2	33.2*	2.55	46.2
	63	34.9	21.6	23.7	25.8	27.9	30.1	2.59	50.2
	67	37.3	16.9	19.1	21.2	23.3	25.4	2.64	54.5
	71	39.8	12.2	14.3	16.4	18.5	20.6	2.69	58.8
95	59	30.9	25.1	27.2	29.4	31.1*	31.9*	2.63	47.0
	63	33.2	20.9	23.0	25.1	27.3	29.4	2.68	51.0
	67	35.6	16.3	18.4	20.5	22.6	24.7	2.74	55.2
	71	38.0	11.5	13.7	15.8	17.9	20.0	2.80	59.5
100	59	29.3	24.4	26.5	28.6	29.8*	30.6*	2.70	47.8
	63	31.5	20.2	22.3	24.5	26.6	28.7	2.77	51.7
	67	33.9	15.6	17.7	19.9	22.0	24.1	2.84	55.9
	71	36.2	10.9	13.0	15.1	17.3	19.4	2.91	60.2
105	59	27.7	23.7	25.8	27.8*	28.5*	29.2*	2.78	48.5
	63	29.8	19.5	21.7	23.8	25.9	28.0	2.85	52.5
	67	32.1	15.0	17.1	19.2	21.3	23.4	2.93	56.6
	71	34.4	10.3	12.4	14.5	16.6	18.7	3.01	60.9
115	59	24.4	22.3	24.5*	25.2*	25.9*	26.6*	2.93	50.1
	63	26.5	18.2	20.3	22.4	24.5	26.6*	3.03	53.9
	67	28.7	13.6	15.8	17.9	20.0	22.1	3.12	58.1
	71	30.9	9.0	11.1	13.3	15.4	17.5	3.22	62.3

CORRECTION FACTORS - OTHER AIRFLOWS
(multiply or add as indicated)

AIRFLOW	1050	1350
TOTAL CAP.	X0.99	X1.00
SENS. CAP.	X0.95	X1.05
COMPR. KW	X1.00	X1.00
A.D.P.	-1.6	+1.2

VALUES AT ARI RATING CONDITIONS

TOTAL NET CAPACITY = 35600 BTUH
AIRFLOW = 1200 CFM
APP. DEW PT. = 55.2 DEG. F
COMPRESSOR POWER = 2740 WATTS
I.D. FAN POWER = 450 WATTS
O.D. FAN POWER = 230 WATTS
S.E.E.R. = 12.00 BTUH/WATT
E.E.R. = 10.40 BTUH/WATT

* DRY COIL CONDITION (TOTAL CAPACITY = SENSIBLE CAPACITY)
TOTAL CAPACITY,COMP. KW AND APP. DEW PT. ARE VALID ONLY FOR WET COILS.
ALL TEMPERATURES IN DEGREES F.

Performance Data Heating

WCY024F—A AT 800 CFM

O.D. TEMP. F.	HEATING CAPACITY (BTUH/1000) AT INDICATED INDOOR DRY BULB TEMP. 60	70	75	80	TOTAL POWER IN KILOWATTS AT INDICATED INDOOR DRY BULB TEMP. 60	70	75	80
-3	5.33	5.17	5.09	5.01	1.52	1.59	1.62	1.65
2	7.28	7.05	6.93	6.82	1.59	1.66	1.69	1.72
7	9.24	8.93	8.78	8.63	1.65	1.72	1.76	1.79
12	11.2	10.8	10.6	10.4	1.72	1.79	1.83	1.87
17	13.2	12.7	12.5	12.2	1.78	1.86	1.90	1.94
22	14.7	14.2	13.9	13.7	1.84	1.92	1.96	2.00
27	16.3	15.7	15.4	15.1	1.89	1.98	2.02	2.06
32	17.8	17.2	16.9	16.6	1.95	2.04	2.08	2.12
37	19.4	18.7	18.3	18.0	2.00	2.09	2.14	2.18
42	20.9	20.2	19.8	19.4	2.06	2.15	2.20	2.24
47	24.9	24.0	23.6	23.1	2.17	2.27	2.32	2.37
52	26.8	25.9	25.4	24.9	2.24	2.34	2.39	2.44
57	28.8	27.8	27.2	26.7	2.30	2.41	2.46	2.51
62	30.8	29.7	29.1	28.5	2.37	2.48	2.53	2.58
67	32.7	31.5	30.9	30.3	2.43	2.54	2.60	2.66
72	34.7	33.4	32.8	32.2	2.50	2.61	2.67	2.73

CORRECTION FACTORS - OTHER AIRFLOWS
(Value at 800 CFM times corr. factor = Value at New Airflow)

AIRFLOW	700	900
HEATING CAP.	X0.98	X1.02
COMPR. KW	X1.02	X0.99

VALUES AT ARI RATING CONDITIONS OF:
70&47/43 (High Temp. Point)
70&17/15 (Low Temp. Point)
AIRFLOW = 800 CFM
HEATING CAP. (High Temp.) = 24000 BTUH
HEATING CAP. (Low Temp.) = 12700 BTUH
COMPR. POWER (High Temp.) = 1720 WATTS
COMPR. POWER (Low Temp.) = 1310 WATTS
HSPF (MIN DHR) = 7.00
COEFF. OF PERF. (High Temp.) = 3.10
COEFF. OF PERF. (Low Temp.) = 2.00
OUTDOOR FAN POWER = 250 WATTS
INDOOR FAN POWER = 300 WATTS

WCY030F—A AT 1000 CFM

O.D. TEMP. F.	HEATING CAPACITY (BTUH/1000) AT INDICATED INDOOR DRY BULB TEMP. 60	70	75	80	TOTAL POWER IN KILOWATTS AT INDICATED INDOOR DRY BULB TEMP. 60	70	75	80
-3	5.71	5.53	5.44	5.35	1.83	1.91	1.95	1.99
2	8.18	7.90	7.76	7.62	1.90	1.99	2.03	2.07
7	10.6	10.3	10.1	9.89	1.97	2.06	2.10	2.15
12	13.1	12.6	12.4	12.2	2.04	2.13	2.17	2.22
17	15.6	15.0	14.7	14.4	2.10	2.20	2.25	2.30
22	18.6	17.9	17.6	17.2	2.18	2.28	2.33	2.38
27	21.6	20.8	20.4	20.0	2.26	2.36	2.41	2.47
32	24.7	23.7	23.2	22.8	2.33	2.44	2.50	2.55
37	27.7	26.6	26.1	25.6	2.41	2.52	2.58	2.64
42	30.7	29.5	28.9	28.3	2.49	2.60	2.66	2.72
47	30.4	29.2	28.6	28.0	2.51	2.63	2.69	2.75
52	32.8	31.6	30.9	30.3	2.58	2.70	2.76	2.82
57	35.3	33.9	33.2	32.6	2.65	2.77	2.84	2.90
62	37.8	36.3	35.6	34.8	2.71	2.85	2.91	2.98
67	40.2	38.7	37.9	37.1	2.78	2.92	2.98	3.05
72	42.7	41.0	40.2	39.4	2.85	2.99	3.06	3.13

CORRECTION FACTORS - OTHER AIRFLOWS
(Value at 1000 CFM times corr. factor = Value at New Airflow)

AIRFLOW	875	1125
HEATING CAP.	X0.98	X1.02
COMPR. KW	X1.02	X0.99

VALUES AT ARI RATING CONDITIONS OF:
70&47/43 (High Temp. Point)
70&17/15 (Low Temp. Point)
AIRFLOW = 1000 CFM
HEATING CAP. (High Temp.) = 29200 BTUH
HEATING CAP. (Low Temp.) = 15000 BTUH
COMPR. POWER (High Temp.) = 2020 WATTS
COMPR. POWER (Low Temp.) = 1590 WATTS
HSPF (MIN DHR) = 7.25
COEFF. OF PERF. (High Temp.) = 3.26
COEFF. OF PERF. (Low Temp.) = 2.00
OUTDOOR FAN POWER = 230 WATTS
INDOOR FAN POWER = 380 WATTS

WCY036F—A AT 1200 CFM

O.D. TEMP. F.	HEATING CAPACITY (BTUH/1000) AT INDICATED INDOOR DRY BULB TEMP. 60	70	75	80	TOTAL POWER IN KILOWATTS AT INDICATED INDOOR DRY BULB TEMP. 60	70	75	80
-3	6.19	6.03	5.95	5.87	2.17	2.28	2.34	2.39
2	9.21	8.95	8.82	8.69	2.25	2.36	2.42	2.47
7	12.2	11.9	11.7	11.5	2.32	2.44	2.50	2.56
12	15.3	14.8	14.5	14.3	2.39	2.51	2.58	2.64
17	18.3	17.7	17.4	17.1	2.46	2.59	2.65	2.72
22	20.6	19.9	19.6	19.3	2.51	2.65	2.71	2.78
27	22.9	22.1	21.8	21.4	2.57	2.70	2.77	2.84
32	25.2	24.4	23.9	23.5	2.62	2.76	2.83	2.89
37	27.5	26.6	26.1	25.7	2.67	2.81	2.88	2.95
42	29.7	28.8	28.3	27.8	2.72	2.87	2.94	3.01
47	36.4	35.2	34.6	34.0	2.89	3.05	3.13	3.21
52	39.4	38.1	37.5	36.8	2.97	3.13	3.21	3.29
57	42.4	41.0	40.3	39.6	3.04	3.20	3.29	3.37
62	45.5	44.0	43.2	42.4	3.11	3.28	3.36	3.45
67	48.5	46.9	46.1	45.3	3.18	3.36	3.44	3.53
72	51.5	49.8	48.9	48.1	3.25	3.43	3.52	3.61

CORRECTION FACTORS - OTHER AIRFLOWS
(Value at 1200 CFM times corr. factor = Value at New Airflow)

AIRFLOW	1050	1350
HEATING CAP.	X0.98	X1.01
COMPR. KW	X1.02	X0.99

VALUES AT ARI RATING CONDITIONS OF:
70&47/43 (High Temp. Point)
70&17/15 (Low Temp. Point)
AIRFLOW = 1200 CFM
HEATING CAP. (High Temp.) = 35200 BTUH
HEATING CAP. (Low Temp.) = 17700 BTUH
COMPR. POWER (High Temp.) = 2370 WATTS
COMPR. POWER (Low Temp.) = 1910 WATTS
HSPF (MIN DHR) = 7.30
COEFF. OF PERF. (High Temp.) = 3.38
COEFF. OF PERF. (Low Temp.) = 2.00
OUTDOOR FAN POWER = 230 WATTS
INDOOR FAN POWER = 450 WATTS

WCY042F—A AT 1400 CFM

O.D. TEMP. F.	HEATING CAPACITY (BTUH/1000) AT INDICATED INDOOR DRY BULB TEMP. 60	70	75	80	TOTAL POWER IN KILOWATTS AT INDICATED INDOOR DRY BULB TEMP. 60	70	75	80
-3	8.88	8.67	8.56	8.45	2.33	2.45	2.51	2.57
2	12.1	11.8	11.6	11.5	2.43	2.55	2.61	2.67
7	15.4	14.9	14.7	14.5	2.52	2.65	2.72	2.78
12	18.6	18.1	17.8	17.5	2.61	2.75	2.82	2.89
17	21.8	21.2	20.9	20.6	2.71	2.85	2.92	2.99
22	23.7	23.0	22.7	22.4	2.76	2.91	2.98	3.06
27	25.6	24.9	24.5	24.1	2.82	2.97	3.05	3.12
32	27.5	26.7	26.3	25.9	2.88	3.03	3.11	3.19
37	29.4	28.6	28.1	27.7	2.94	3.09	3.17	3.25
42	31.3	30.4	29.9	29.5	2.99	3.16	3.24	3.32
47	41.2	40.0	39.4	38.8	3.27	3.45	3.54	3.63
52	44.5	43.1	42.5	41.8	3.36	3.55	3.64	3.74
57	47.7	46.3	45.5	44.8	3.46	3.65	3.75	3.84
62	50.9	49.4	48.6	47.9	3.55	3.75	3.85	3.95
67	54.2	52.5	51.7	50.9	3.64	3.85	3.95	4.06
72	57.4	55.7	54.8	53.9	3.74	3.95	4.06	4.16

CORRECTION FACTORS - OTHER AIRFLOWS
(Value at 1400 CFM times corr. factor = Value at New Airflow)

AIRFLOW	1225	1575
HEATING CAP.	X0.99	X1.01
COMPR. KW	X1.02	X0.99

VALUES AT ARI RATING CONDITIONS OF:
70&47/43 (High Temp. Point)
70&17/15 (Low Temp. Point)
AIRFLOW = 1400 CFM
HEATING CAP. (High Temp.) = 40000 BTUH
HEATING CAP. (Low Temp.) = 21200 BTUH
COMPR. POWER (High Temp.) = 2590 WATTS
COMPR. POWER (Low Temp.) = 1990 WATTS
HSPF (MIN DHR) = 7.35
COEFF. OF PERF. (High Temp.) = 3.40
COEFF. OF PERF. (Low Temp.) = 2.18
OUTDOOR FAN POWER = 260 WATTS
INDOOR FAN POWER = 600 WATTS

LGC (LGM Module Driver v 1.6) Technical Instructions

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Introduction

The LGC is a part of the LANgate family and provides communications between a workstation and a control module network (CMnet) consisting of fewer than 100 modules. The CMnet is a peer-to-peer local area network which uses a "token-passing" protocol to allow all control modules to communicate with one another with equal authority. A workstation can communicate with the CMnet through the LGC when direct-connected (DC) or modem-connected (MC), or it can communicate on the CMnet through any other module with a Direct-Network (DN) connection. The LGC does not have a Direct-Network (DN) connection.

The LGC communicates with the CMnet through an EIA-485 port. Signal integrity on the CMnet is affected by the wire gauge and the total amount of wire in the segment. A segment is the network of modules between gateway modules or repeaters. Repeaters, which boost communication signals, are available from ALC for legacy (9600 bps or 38.4 kbps) CMnets and for ARCNET (156 kbps) CMnets. Ask for part number REPOPT or REP485, respectively.

The LGC provides two EIA-232 console ports and an Access port for connecting to a workstation, portable computer, or modem. These ports can communicate at speeds of 9600 bps or 38.4 kbps. The Access port requires a signal converter (ALC part number APT) and is designed for transferring memory or troubleshooting. When an ARCNET CMnet is used, the Access port can receive colors but cannot receive alarms.

NOTE: You must use FB Link v2.7a or later in order to download to any module containing Exec 6 or later.

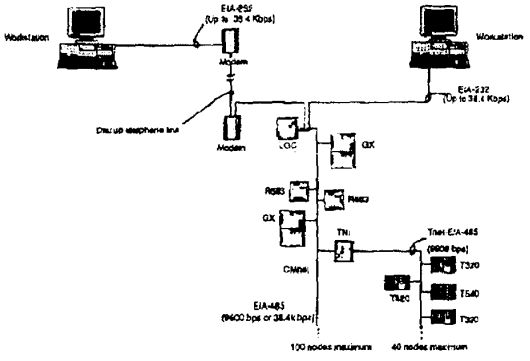

Figure 1: Network Architecture

Specifications

Power: 24VAC±10%, 50-60Hz, 7.2VA.

Console Ports: Two EIA-232 serial ports (one D-sub 9-pin connector and one 5-pin pluggable screw terminal block) switch selectable for 9600 bps or 38.4 kbps.

CMnet Port: EIA-485, twisted pair, selectable for 9600 bps, 38.4 kbps, or 156 kbps, optically isolated.

Status Indication: Visual (LED) status of EIA-232 communication, CMnet communication, running, errors, and power.

Temperature Range: 0-130 °F (-17.8 to 54.4 °C); relative humidity 10-90%, non-condensing.

Protection: Built-in surge and transient protection circuitry.

Listed By: UL 916 (PAZX), C-UL C22.2 No. 205-M19 (PAZX7).

Mounting

Mount the LGC in an enclosed panel using the four holes provided on the module's cover plate (see figure 2). Make sure that nothing comes in contact with the back of the printed circuit board, and leave approximately 2 inches (5 cm) on each side for wiring.

The LGC is designed to be mounted inside the building envelope. All warranties are void if mounted outside.

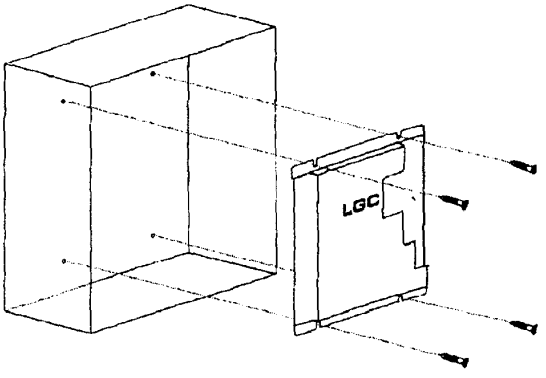

Figure 2: Mounting the LGC

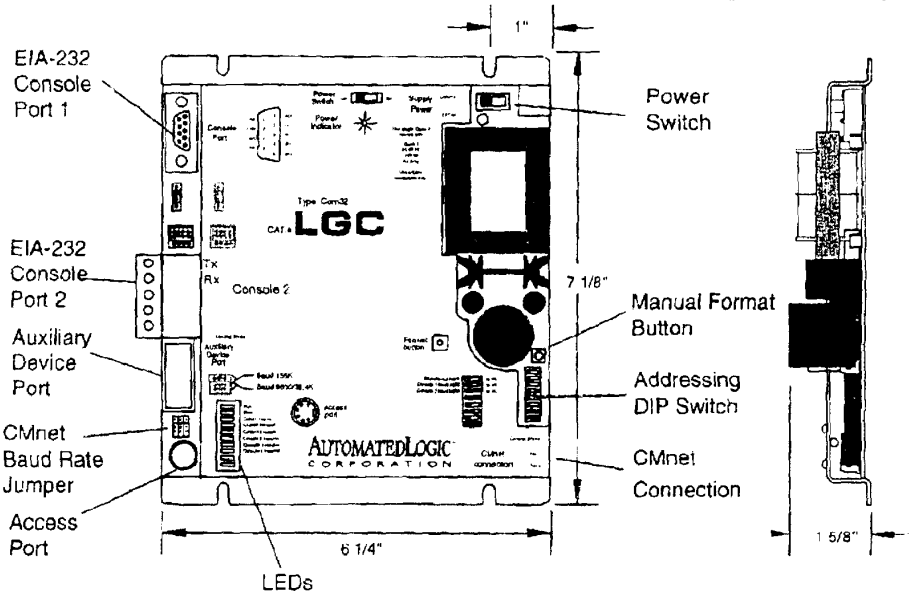

Figure 3. LGC Module Dimensions and Layout

Power Wiring

CAUTION: The LGC modules are Class 2 devices (less than 30 VAC). Take appropriate isolation measures when mounting an LGC module in a control panel where non-Class 2 devices or wiring are present.

1. Turn the LGC's power off. This prevents the module from being powered up before the proper voltage is verified.
2. Make sure that the 24VAC power source is off.
3. Connect the power wires to the module's power terminals labeled Gnd and 24 VAC (see figure 4).
4. Apply power to the transformer.
5. Make sure that 24 VAC is present at the module's power input terminals.
6. Turn the module's power switch on.

   When the LGC turns on, the Power LED turns on and the Run LED turns on and begins blinking. (See figure 3 for the LED's location.) If the module does not respond, call Technical Support at (770) 429-3002.

CMnet Communications

ALC recommends that you use a dedicated, 22AWG to 18AWG twisted pair copper wire for CMnet (EIA-485) wiring. Wire sizes smaller than 22 gauge or wires that are not twisted may cause intermittent communication problems. For more information about CMnet wiring, refer to the *Technical Handbook* or to the *156K Wiring Technical Instructions*.

You can use only one LGC on a CMnet.

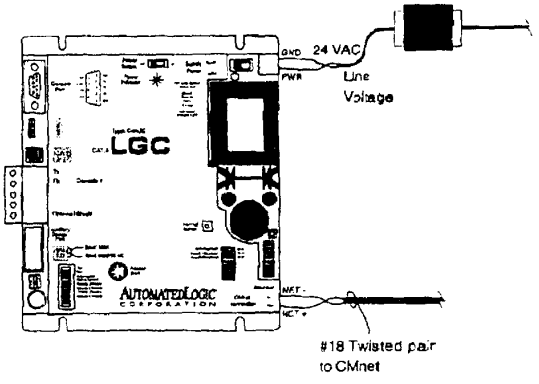

Figure 4: Power and Communication Wiring

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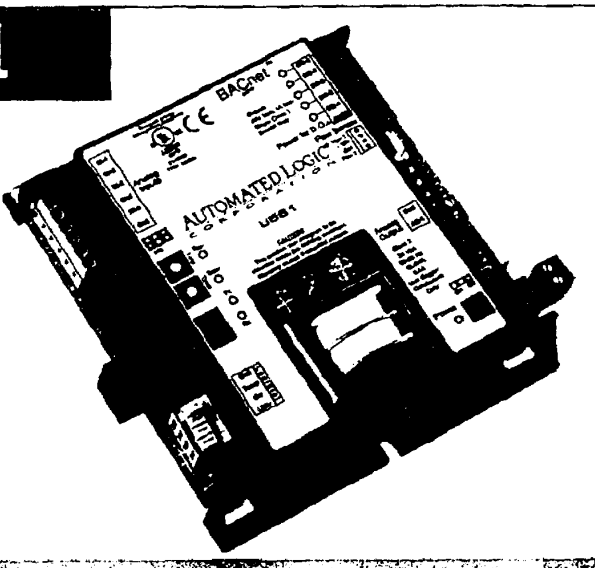
U551



Versatile Unitary Controller for Heat Pumps, Fan Coil and Other Applications

The U551 unitary controller is designed for a variety of HVAC terminal unit control applications including Heat Pumps, Unit Ventilators and Fan Coil Units. Part of the InterOp™ system, the U-line controllers communicate using BACnet™ MS/TP over EIA-485 on twisted pair. U-line controllers communicate via the UNI, a unitary controller router that can network multiple U-line controllers to other parts of the InterOp system.

Key Features and Benefits

- Versatile controller suitable for a variety of HVAC packaged terminal unit applications including heat pumps, unit ventilators and fan coil units.
- Uses native BACnet MS/TP communications - the ASHRAE industry standard protocol for interoperability.
- Compatible with the LogiStat series of smart room sensors.
- Built-in 0-10VDC AO available for modulating valve or damper control.
- Compact and rugged plastic enclosure for easy mounting.
- Optical isolation provided on the communication network for protection.
- Uses a 16-bit microprocessor with Flash memory for future upgrades that can be remotely downloaded - no firmware changes!
- Optional single/dual air flow sensors for pressure independent VAV applications.

The U551 unitary controller is fully programmable and includes a backup default algorithm for full standalone operation. In conjunction with LogiStat Plus or Pro, the controller offers a local setpoint adjustment and override into an occupied mode. Override information can then be reported to workstation software, SuperVision, for tenant billing.

Engineered for quality and reliability in the field, the U551 boasts a robust electronic design that enables building operators to easily upgrade firmware in the future with minimal cost.

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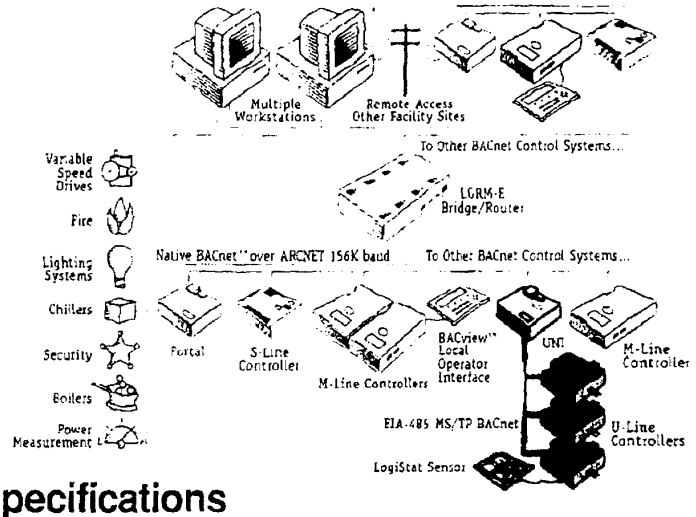
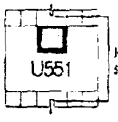


U551 Specifications

Power:	24VAC ±10%, 7.5VA, 50-60Hz. Dual power connection comprised of double terminal strips for easy wiring and multi-dropping 24VAC power between multiple U-line controllers.
Physical:	Rugged GE C2905HG Cycoloy plastic - UL 94 V-0 fire retardant for plenum mounting.
U-line Communication:	Native BACnet™ MS/TP, ASHRAE's industry standard protocol.
Media:	EIA-485 twisted pair, selectable between 9600 and 38.4K baud. Wire terminates into a removable terminal strip.
Optional Air Flow Sensor:	Compatible with U-line Single air Flow sensor (USF) or U-line Dual air Flow sensor (UDF) for pressure independent VAV applications. Connects directly with cable/connector provided with USF and UDF.
Microprocessor:	16-bit Hitachi H8 microprocessor.
Memory:	2KB RAM, 60KB Flash.
Digital Outputs:	Five digital outputs, relays rated at 1A resistive @ 24VAC.
Universal Inputs:	Five universal inputs, 0-5VDC, 10K ohm Thermistor (BAPI Type II curve), LogiStat series of smart sensors.
Analog Outputs:	One analog output, 0-10VDC (5mA max).
Environmental Operating Range:	0° to 130°F (-17.8° to 54.4°C), 10%-95% RH non-condensing.
Protection:	Surge and transient protection circuitry for power, inputs, outputs and optical isolation for communications.
Listed By:	UL916 (Canadian Std. C22.2 No.205-M1983), CE (1997). FCC (Part 15 - Subpart B - Class A).
Weight:	0.7 lb. (0.31Kg)
Overall Dimensions:	5-1/16" (width) by 5-11/16" (height) by 1-1/2" (minimum panel depth). 129mm (width) by 144mm (height) by 38mm (minimum panel depth).
Mounting:	Two mounting holes center line as below with 5-9/16" (141mm) spacing (height).



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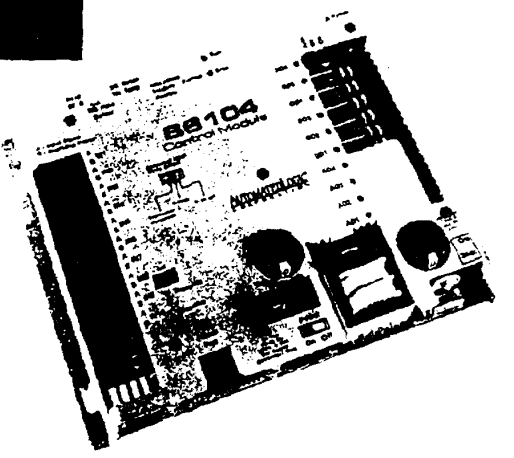
S-Line



S-Line: Engineered for Single Equipment Applications

S-line control modules are part of the Automated Logic Corporation InterOp™ system, which includes the M-line (multi-equipment application) and U-line (unitary-equipment application) control modules. S-line standalone controllers bring rugged dependability to single-equipment applications. Superior design means they stand up to a range of environmental conditions, and even rooftop installations. S-line controllers utilize native BACnet™ communications over a high speed ARCNET 156K baud network for superior performance.

Key Features and Benefits

- Single-equipment design facilitates implementation of dedicated custom control strategies.
- Native BACnet communication over a high speed ARCNET 156K baud network.
- Graphical programming with EIKON - easy self documenting programming.
- Tough construction delivers superior performance and reliability in the field.
- Removable screw terminal strips simplify maintenance.
- 32-bit microprocessor.

The S6104 control module is an excellent choice for rooftop environments and is mountable directly in or on rooftop equipment. With powerful 32-bit microprocessor technology, universal inputs, and digital and analog outputs, S-line control modules are a perfect match for all types of single-equipment control situations.

Support for EIKON graphical programming also provides an unmatched capability to engineer complex control sequences, verify performance, and generate instant documentation all without special programming expertise. EIKON makes it easy to customize the control algorithms for a variety of operation sequences.

Each S-line controller is fully programmable and offers full peer-to-peer communications with other S-line or M-line controllers.

Circuit boards in S-line units are protected by a rugged aluminum cover, which also provides optimum electrical protection and noise immunity by serving as a ground plane. The aluminum cover also offers flexible mounting options. Every S-line controller features removable screw terminal strips to simplify installation and maintenance.

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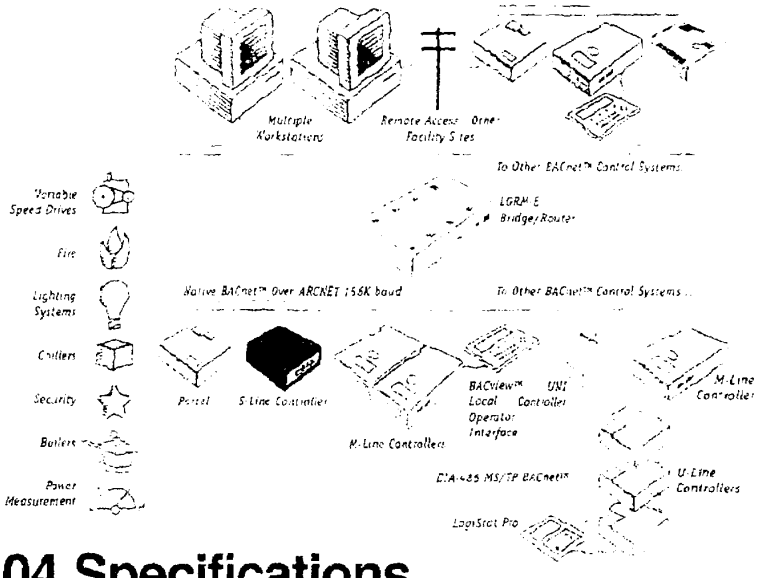
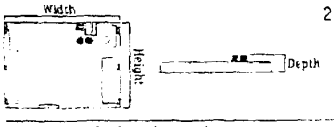
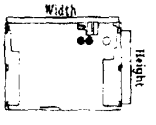


S6104 Specifications

Power:	24VAC ± 10% 20VA.
Physical:	Rugged aluminum cover. Removable screw terminal blocks.
Protection:	Surge and transient protection circuitry for power and communications.
Communication:	BACnet™ over ARCNET 156K baud (or CMnet for backwards compatibility with existing ALC systems). Includes optically isolated communication port and diagnostic port.
Microprocessor:	32-bit Motorola MC68-series microprocessor.
Memory:	512K byte of Flash memory and 128K byte of non-volatile battery-backed RAM
Environmental Operating Range:	-20°-150°F (-28.9 to 65.6°C), 10-95% RH non-condensing.
Digital Outputs:	Six digital outputs, relay contacts rated at 3A resistive @ 24VAC. Hand-Off-Auto switches. LED indication.
Universal Inputs:	Ten universal inputs, 0-5VDC, 4-20mA (input burden 500 Ohms). Thermistor (3API Type II curve).
Resolution:	10 bit A/D.
Input Pulse Frequency:	10Hz (minimum 50mS pulse width).
Analog Outputs:	Four analog outputs, 0-10VDC, 0-20mA, LED indication.
Resolution:	8 bit D/A.
Listed By:	UL916 (Canadian Std C22.2 No.205-M1983), CE, FCC Part 15 - Subpart B - Class A.
Overall Dimensions:	8-7/8" (width) by 7-1/2" (height) by 2-3/4" (recommended panel depth). 225mm (width) by 191mm (height) by 70mm (recommended panel depth).



Mounting Hole Dimensions:	8-5/16" (width) by 5" (height). 213mm (width) by 127mm (height).



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RESOLUTION NO. 2000-94

A RESOLUTION OF THE LODI CITY COUNCIL AUTHORIZING THE CITY MANAGER TO PROVIDE A PUBLIC BENEFITS PROGRAM GRANT TO UNITED CONGREGATIONAL CHURCH

==========

WHEREAS, the State has mandated that beginning January 1, 1998, the City of Lodi is obligated to fund various programs through a Public Benefits Charge (PBC) based on a historical electric revenue requirement; and

WHEREAS, the requirement amounts to approximately $1M per year that must be dedicated to qualifying programs such as energy efficiency. A further stipulation is that these efforts must be done on the customer's side of the meter in order to qualify; and

WHEREAS, the City of Lodi Electric Utility, in partnership with Energy Masters, International, completed a Comprehensive Energy Engineered Analysis of United Congregational Church located at 701 S. Hutchins Street. As a result of this assessment, it has identified specific energy conservation measures and the associated energy, maintenance and operational savings that could be implemented as part of United Congregational's overall construction project. Specifically, United Congregational Church will be installing and/or retrofitting the following items within their facility:

- removing a number of inefficient HVAC (heating & cooling) units on the classroom area of the church property, and installing new, highly efficient HVAC heat pump units;
- retrofitting all existing classroom, office space and sanctuary lighting with state-of-the-art fluorescent lighting and associated controls;
- installing a new, 15-ton energy efficient air cooled chiller (air conditioning system) for the sanctuary;
- replacing the existing boiler, with a new, highly efficient piece of equipment that will compliment the aforementioned 15-ton chiller;
- installing a new automated control logic system (often referred to as an energy management system) designed to allow church personnel the ability to remotely schedule (turn on/off) and operate the facilities HVAC system.

WHEREAS, the Public Benefits Program Grant in the amount of $75,769.75 reflects a 25% energy efficiency incentive rebate for the total cost of the project to United Congregational Church. The 25% rebate is consistent with all other rebates offered to commercial and industrial electric utility customers throughout Lodi that participate in the City of Lodi Energy Services Partnership Program (which is an element of the City of Lodi Public Benefits Program).

WHEREAS, the Electric Utility Department recommends that the City provide a Public Benefits Program Grant of $75,769.75 for a demand-side management project at United Congregational Church.

BE IT RESOLVED, that the Lodi City Council hereby authorizes the City Manager to provide a Public Benefits Program Grant in the amount of $75,769.75 to United Congregational Church for a Comprehensive Energy Engineered Analysis.

Dated: June 7, 2000

==========

I hereby certify that Resolution No. 2000-94 was passed and adopted by the Lodi City Council in a regular meeting held June 7, 2000 by the following vote:

AYES: COUNCIL MEMBERS – Hitchcock, Land, Nakanishi, Pennino and Mann (Mayor)

NOES: COUNCIL MEMBERS – None

ABSENT: COUNCIL MEMBERS – None

ABSTAIN: COUNCIL MEMBERS – None

JACQUELINE L. TAYLOR
Interim City Clerk